

PROJECT ID 1440-13/15-00 FHWA-WI-EIS-04-03-LS SF
WISCONSIN STATE HIGHWAY 23
FOND DU LAC to PLYMOUTH
FOND DU LAC AND SHEBOYGAN COUNTIES, WISCONSIN

LIMITED SCOPE SUPPLEMENTAL FINAL ENVIRONMENTAL IMPACT STATEMENT,
RECORD OF DECISION

And Section 4(f) Evaluation Combined
Submitted Pursuant to 42 U.S.C. 4332(2)(c), 49 U.S.C. 303, and
Public Law 112-141, 126 Stat. 405, Section 1319(b)

By the
U.S. Department of Transportation
Federal Highway Administration
and
Wisconsin Department of Transportation

COOPERATING AGENCY
U.S. Army Corps of Engineers (pursuant to 33 CFR 230)

APPROVALS

3/17/14

Date

For Federal Highway Administration

3/17/14

Date

For Wisconsin Department of Transportation

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ABSTRACT

Wisconsin Highway 23 is part of the National Highway System (NHS) and is a rural principal arterial that connects Fond du Lac and Sheboygan in east central Wisconsin. Both west and east ends of the project are located in the growing urban areas of Fond du Lac and Plymouth. Nearly 20 miles in length, this highway corridor serves high traffic volumes near the urban areas and lower traffic volumes in rural areas. This combined Limited Scope Final Environmental Impact Statement and Record of Decision (LS SFEIS/ROD) evaluates the No- Build Alternative, several Build Alternatives, and a series of corridor preservation alternatives for future transportation improvements, and selects an alternative. The Preferred Build Alternative is the Selected Alternative and reconstructs WIS 23 to a 4-lane divided highway on the existing alignment and creates interchanges, connector roads, and a trail. Corridor preservation alternatives evaluate areas needed for future interchanges, overpasses, and connector roads as well as the US 151/WIS 23 interchange.

FHWA and WisDOT have prepared this Limited Scope Supplemental Final Environmental Impact Statement (LS SFEIS) in accordance with Title 23, Part 771.130 (f) of the Code of Federal Regulations (23 CFR 771.130). This LS SFEIS is used to address issues of limited scope associated with the overall project.

This Record Of Decision has been prepared in accordance with 23 CFR 771.127, 40 CFR 1505.2 and Public Law 112-141, 126 Stat. 405, Section 1319(b)

NATIONAL ENVIRONMENTAL POLICY ACT STATEMENT

The National Environmental Policy Act (NEPA), 42 USC 4321-4347, became effective January 1, 1970. This law requires that all federal agencies have prepared for every recommendation or report on proposals for legislation and other major federal actions significantly affecting the quality of the human environment a detailed Environmental Impact Statement (EIS). The Federal Highway Administration (FHWA) is therefore required to have prepared an EIS on proposals that are funded under its authority if the proposal is determined to be a major action significantly affecting the quality of the human environment.

EISs are required for many transportation projects as outlined in NEPA. This Limited Scope Supplemental Environmental Impact Statement (LS SEIS) follows the same procedure as an original EIS, except that scoping is not required [40 CFR 1502.9(c), 23 CFR 771.130]. The processing of the LS SEIS is carried out in two stages. Limited Scope Supplement Draft EISs (LS SDEIS) are first written and forwarded for review and comment to federal, state, and local agencies with jurisdiction by law or special expertise and it is made available to the public. The LS SDEIS must be made available to the public at least 15 days before the public hearing and no later than the first public hearing notice or notice of opportunity for a hearing. A minimum 45-day comment period is provided from the date the LS SDEIS notice of availability is published in the Federal Register. WisDOT must receive agency and public comments on or before the date listed on the front cover of the LS SDEIS unless a time extension is granted by the FHWA and the Wisconsin Department of Transportation (WisDOT). After the comment period for the LS SDEIS has elapsed, preparation of the Limited Scope Supplemental Final EIS (LS SFEIS) can begin. It includes:

1. Basic content of the Draft Statement (or Supplemental Draft Statement), as amended, due to internal agency comments, editing, additional alternatives being considered, and changes due to the time lag between the Draft, Supplemental Draft, and Final EIS.
2. Summary of public hearing comments.
3. Summary of written comments received on the Draft Statement or Supplemental Draft Statement.
4. Evaluation and response to substantive comments.

A Record of Decision (ROD) is the administrative action that approves the selected alternative. Public Law 112-141, 126 Stat. 405, Section 1319(b) states that to the maximum extent practicable, the lead agency shall expeditiously develop a single document that consists of a FEIS and a ROD. This environmental document is a combined LS SFEIS/ROD.

The name, address, and telephone number of the individual from whom additional information can be obtained is listed on the cover of this document.

GENERAL REVIEWER INFORMATION

This combined LS SFEIS and ROD has been combined with the original 2010 FEIS for ease of review. Original 2010 FEIS text is shown in black. Items that are considered revisions that target specifically identified issues in the January 19, 2012 Notice of Intent to prepare an LS EIS are shown in blue text. This document has also been updated to reflect changes to data, policies, or conditions since the 2010 FEIS was published. These updates are shown in maroon text. Text that has changed between the LS SDEIS and this LS SFEIS/ROD is highlighted in yellow or is designated by lines in the margin. In addition, for ease of review, a summary of changes is provided at the beginning of each section.

Project Location

Project 1440-13/15-00

WIS 23

Fond du Lac and Sheboygan Counties

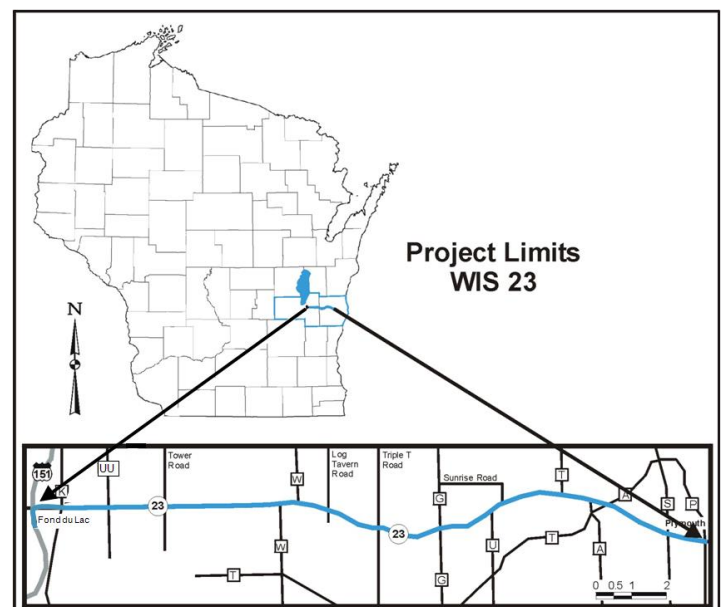


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The Appendices only contain information that is new since the release of the 2010 FEIS. This includes updated traffic (Appendix LS-A), Purpose and Need Screening (Appendix LS-B), Indirect and Cumulative Effects (Appendix LS-C), Current Correspondence (Appendix LS-D), and an updated list of preparers (Appendix LS-E), the 2010 ROD (Appendix LS-F), and a distribution list (Appendix LS-G). The appendices from the 2010 FEIS are provided in a CD on the back cover of this LS SDEIS.

9.0 APPENDICES

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APPENDIX LS-A
TRAFFIC TECHNICAL MEMOS

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CORRESPONDENCE/MEMORANDUM**State of Wisconsin**

Date: 4-25-2012

To: Tracey Blankenship
Bethaney Bacher-Gresock
Andrew Brinkerhoff
Jay Waldschmidt

From: Jill Michaelson

Subject: Project 1440-13-00
WIS 23 (Fond du Lac - Plymouth)
Fond du Lac and Sheboygan Counties

Re: Forecasting

Traffic Counts

Forecasts for the WIS 23 major project have been projected using 2001, 2005, 2008, 2011, and 2012 traffic counts. The 2011 and 2012 traffic counts are lower than previous count years. In general, statewide counts seemed to peak in about 2005. The decline in traffic counts may be linked to the down turn in the economy, unemployment rates and other factors.

WIS 23 is not the only corridor which has experienced a decrease in traffic counts. WIS 15 (New London – Greenville) traffic counts have also decreased. WIS 15 is being recounted to rule out the potential for equipment malfunctions. WIS 23 was counted with the same equipment. WIS 23 will be recounted again in June.

Traffic counts are checked when they are received by the WisDOT forecast unit with the forecast request. If they change more than 20% in either direction, a re-count or an explanation may be requested of the regional office to try to understand possible causes.

Forecasting Methodology

Traffic forecasts report travel behavior that will occur in a roadway design year (20 years after anticipated construction) or in a long-range plan projection year. As per WisDOT Facilities Development Manual (FDM) Section 3-10-10, federal- and state-funded projects require traffic forecasts (projections) performed and/or approved by the forecasting unit in Central Office. Forecasts are prepared and approved centrally to

assure that a consistent methodology is utilized for all forecasts in the state. The following types of forecasts exist; facility, corridor, traffic impact analysis, turning movement, expansion (new roadway) and alternatives analysis.

FDM Section 3-10-10 requires forecasts for the following project types:

1. Resurfacing
2. Pavement Replacement
3. Reconditioning
4. Reconstruction
5. Capacity Expansion
6. Bridge Replacement
7. Access Control
8. Corridor Studies

The forecasting unit transforms a wide array of traffic and socio-economic data into forecasts and related traffic information.

Forecasts requested for projects that fall within an MPO jurisdiction or regional travel demand model area are required to utilize the model as a tool to complete the forecast. Local Road Forecasts and/or the Traffic Analysis Forecast Information System (TAFIS) are compared to the model output when applicable.

For the 2012 forecasts, the NE Region Travel Demand Model (TDM), latest version fall 2011, was used. Models incorporate road networks, land use, demographic, and economic data to replicate existing and future traffic conditions. Models provide the basis to generate traffic projection forecasts and are used for statewide, regional and project-specific traffic forecasting purposes. Models use socioeconomic and land use data to help determine origins and destinations throughout the region. Traffic counts are used in post-processing when the growth rate from the model is applied and to validate the model after it is updated.

Models are a very useful tool in traffic forecasting, particularly in alternatives analysis forecasting and in forecasting growth based on specific socioeconomic factors. However, because of the difficulty in calibrating and validating the models, the raw assigned traffic can misrepresent the actual traffic volumes. This will show up in the model's base year data and can be tested by comparing the raw base year traffic assignment to the counts on corresponding road segments or "links." Usually, if a factor in the model causes the raw base year assignment to be higher than the corresponding count, it will also cause the future assignment to be high (over-assignment). The same is true for assignments that are lower than the corresponding counts (under-assignment).

To account for the differences between base year assignments and counts, a set of methodologies was produced by the Transportation Research Board and published in the National Cooperative Highway Research Program (NCHRP) Report #255 Highway Traffic Data for Urbanized Area Project Planning and Design (1982). The methods

include: Difference Adjustment, Ratio Adjustment, and an Average of Difference and Ratio Adjustment. Standard WisDOT policy is to use the best methodology for each individual situation based on recommendations from the NCHRP report. The most important aspect in using a methodology is that it, and its output, makes sense. These methodologies also set a standard for adjusting the raw future year assignment based on the base year assignment and count values.

Further adjustments to the forecast value are required when the base year count is not the most recent count on a segment for which a forecast is requested. The most recent count is the most valuable piece of traffic forecasting information. As is the policy for forecasts completed outside of model areas using Local Road Forecasts and TAFIS, the most recent count is the starting point from which the line that represents the future year forecasts begins. A new count that is higher than previous counts will shift this forecast line up, and a new count that is lower will shift the forecast line down. In model areas, the growth rate, which is represented by the slope of the future year forecast line, is based on the model average annual growth rate. The growth rate is then applied to the most recent count to create the future year forecast values. The growth rate may not be less than 0.5% or greater than 5% unless there is significant change in model inputs such as socioeconomic data or the road network. As always, judgment should be used to determine if the applied growth rate makes sense intuitively and compared to TAFIS.

The Traffic Analysis Forecast Information System (TAFIS) tool was also used for the 2012 projections. TAFIS contains tabular and spatial traffic count data in an ArcGIS system. WisDOT collects traffic count data from almost 7,000 sites in the State. Data is collected in every Wisconsin county on a 3-year cycle. The traffic count relational database is the source of TAFIS data. The forecasting unit views and downloads count data.

Cyclical data from previous traffic counts has ongoing forecasting and statistical value. Data in this series is used to generate statewide, regional and project-specific traffic forecast projections and maps. The forecasting unit compares current and older data for regression analysis purposes (use Box-Cox method), to determine future traffic forecast projections based on past growth. TAFIS is updated regularly.

When no travel demand models are available, the forecasting unit can only use the TAFIS output with manual adjustments to the output. This was the situation prior to the development and adoption of the NE Region TDM. This was the basis of the 2005 forecasts. Those forecasts are based on “unconstrained” output, based on past counts projected forward without any regard to facility type.

The 2012 forecasts are considered “constrained” forecasts. In other words, the traffic output to the system is influenced by the amount of traffic the system can handle. Change in the number of lanes does not add trips. The model simply redistributes the trips that are already generated by the future socioeconomic data to address the network changes. The forecasting unit compares the results to the TAFIS output.

The slopes or growth rates generated by the model are checked against the TAFIS system and traditional regression methods, and future forecast values should be within 10% of those produced by TAFIS for that corresponding future year. If the forecast values created by a travel demand model are greater than 10% different than TAFIS, a compromise number should be reached. This [compromise] number should generally be the edge of the accepted 10% range in TAFIS, as long as it is also within 10% of the model forecast value. The travel demand model growth rate is preferred to a regression-based growth rate because it can account for anticipated changes in population and employment in specific locations, while the regression-based growth rates are simply formulas applied to the past and current counts on that site, with no intelligence on why those changes occurred.

If poor calibration in the travel demand model is suspected (only a problem on very low-volume local roads), a Local Roads Forecast or TAFIS forecast may produce a better forecast value. If an adjustment is necessary, a note should be made explaining the reason for the difference between TAFIS and the Travel Demand Model. The basis for this policy is present in a document entitled “Criteria for Accepting or Overriding a STH System Traffic Forecast with an Urban Travel Demand Model” which can be found in the Miscellaneous Section of the 1991 Travel Demand Forecasting and Analysis Handbook produced by the Traffic Forecasting Section.

WIS 23 Forecasts

Forecasts can vary annually based on the information available. Below are the count, forecast and growth rate data for 2005, the basis for the original preferred alternate selection:

Table 1: Central Office No Build Forecast (2005 Counts)

Location	Count	Forecast	Growth
Year	2005	2036	Rate
US 151 – CTH K	11425	18600	2.0
CTH K – CTH UU	8600	13025	1.7
CTH UU – Hinn Rd	8200	12525	1.7
Hinn Rd – CTH W	8600	16050	2.8
CTH W – CTH G	7625	12400	2.0
CTH G – CTH A	9150	14900	2.0
CTH A - CTH P	9525	17375	2.7

Central Office forecast used Box-Cox method and some manual adjustments.

The WIS 23 major project is considered a committed project because it has been enumerated for construction. It is appropriate from the sense of applying a forecast to this project to use “no build” and “build” forecasts that coincide with the respective alternative types that are considered in the supplemental EIS.

DTSD and DTIM met on March 12, 2012 to discuss the updated forecast and travel trends in the area. There was consensus to move forward with the latest forecasts based on 2012 counts below.

Table 2: Central Office Forecasts (2012 Counts)

Site ID	2012 Counts	2035 No Build ¹	2035 Passing Lane Without Left Turns ¹	2035 Passing Lane with Left Turn Lanes and Median Refuge ¹	2035 Hybrid 4-Lane to CTH G Passing Lane CTH G to CTH P ¹	2035 4-Lane Build On Alignment ¹
US 151 – CTH K	10484	15,700	14,600	14,600	14,900	17,600
CTH K – CTH UU	9455	11,000	11,800	11,800	12,300	13,400
CTH UU – Hinn Rd	7452	9,100	9,600	9,600	10,200	11,200
Hinn Rd – CTH W	7650	8,900	9,900	9,900	10,500	10,800
CTH W – CTH G	7084	7,900	8,700	8,700	9,400	9,500
CTH G – CTH A	6434	7,200	7,500	7,500	8,300	8,800
CTH A - CTH P	7439	8,200	8,400	8,400	9,100	9,600

¹ **Constrained Forecast Produced with Travel Demand Model and TAFIS** - As a result of the statistical analysis conducted, any official forecast produced will not necessarily match outputs of either TAFIS or the travel demand model directly. The Northeast Travel Demand Model was completed for forecasting purposes in this area of the state, in Fall 2010. Forecasts completed 2/9/2012. Note: Whether or not left turn lanes are built does not affect the passing lane forecast results as long as it is not divided and the posted speed remains the same.

Traffic increases for the “build” alternatives over the “no build” alternative, as shown in Table 2 above, are due not to added area trips but to the redistribution of area trips by the travel demand model. The number of trips already generated by future growth will travel on highways based on the amount of traffic the system can handle. When passing lanes are added and/or capacity is expanded to four lanes, WIS 23 will experience better traffic operations and/or be able to handle more traffic.

Environmental Document

The original projected design year traffic volumes were a key justification for the selection of the preferred Four-Lane, On-Alignment Build Alternative and the dismissal of the Passing Lane Alternative.

The 2012 forecasts for the “No Build”, “Passing Lane without Left Turns”, “Passing Lane with Left Turn Lanes and Median Refuge”, “Hybrid 4-Lane to County G, Passing Lane County G to County P” and “4-Lane Build On Alignment” conditions will be discussed in the environmental document as one of several criteria to determine if an alternative meets the project purpose and need.

WIS 23 Traffic Count and Forecast History Memo

September 27, 2012

Purpose of Memo

In response to litigation filed against FHWA and WisDOT, it was determined appropriate to update portions of the Environmental Impact Study and publish a Supplemental Environmental Impact Study (SEIS). Existing traffic analysis had used traffic information from 2005. Being nearly 7 years old, it was decided it would be prudent to update the SEIS using the most recent traffic data. An updated forecast was created in January 2012. However, the results of the forecast were questioned by project staff and triggered much discussion. Subsequently, additional traffic counts were requested and associated forecasts were completed. FHWA had questions about these processes and reasons for performing the additional work. This memo is a detailed explanation by the NE Region and DTIM to provide a background and history for the reasons additional information was requested and will explain the process followed for taking counts and creating forecasts.

This memo outlines standard practice for data requests, data collection and data quality checks for this project which generally describes Department procedures.

Memo Outline

- I. Traffic Counting
 - A. Standard Practices
 - B. Raw Counts (See attached map with Raw Data (Unfactored) locations)
WIS 23 Count Data – Tables 1, 1A, 1B
 - C. Factors and Factored Counts (See attached map with Factored Data locations)
WIS 23 Factored Counts - Table 2, 3
- II. Traffic Forecasting
 - A. Standard Practices
 - B. Methodology
WIS 23 Corridor Traffic Forecasts and Forecasting Tools – Table 4
 - C. Forecasts Using WIS 23 AADT's – Tables 5, 6, 7, 8
- III. Evaluation and Validation
- IV. Conclusion

I. TRAFFIC COUNTING

A. Standard Practices

Annual average daily traffic counts (AADT) are reported as the number of vehicles expected to pass a given location, or count site, on an average day of the year. The region sets out counters and collects the raw count data. The Central Office Data Management Section (DMS) processes the raw counts to develop AADTs. The AADT at a coverage count site is based on a short-term traffic count, usually 48 hour intervals, taken at the location. This count is then adjusted for the variation in traffic volume throughout the year and the average number of axles per vehicle. When the raw count is first processed, a *preliminary* AADT is generated using factors based on continuous data from the previous year. Part of the annual processing of all traffic count data is the generation of new factors based on current year continuous data. These current year factors are then applied to all of the short-term counts taken during the year to compute a *final* AADT for each site.

Short-term traffic counts (coverage counts) are collected over a three-year cycle at over 26,700 rural and urban locations throughout the state. Counties were assigned to the three-year cycle in a way that attempted to minimize the difference in the number of counts needed to be taken each year. DMS assigned individual count sites to the three, six or “ten” year cycle based on their functional classification and traffic volume.

- Subcycle 3 is comprised of principal arterials, minor arterials with an AADT of 5,000 or more, HPMS and NHS segments, ramps needed for mainline count balancing and ramps in an interchange where at least one leg has an AADT of 2,000 or more. These sites are counted every three years.
- Subcycle 6 is comprised of minor arterials with AADT less than 5,000, collectors with an AADT of 2,000 or more, and ramps in interchanges where all legs have AADTs of less than 2,000. Half of these sites are counted in even numbered years (6E) and the other half are counted in odd numbered years (6O).
- Subcycle 10 is comprised of collectors with an AADT of less than 5,000. These sites are counted only in years ending in 9, 0 or 1.

In years ending in 9, 0 or 1, all short term sites in the appropriate cycle are counted regardless of subcycle. This is done to match up counts on all roads with the decennial census data collection. It was also intended to match the timing of functional classification changes, but that is no longer the case.

Scheduled coverage counts should not be taken if they would be influenced by highway construction, detours, holidays or other special events. The goal is to collect data when traffic is as close to “normal” as possible. If necessary, these sites could be collected in an off-cycle year as a special count.

Most coverage counts are taken with TimeMark Delta NT traffic data recorders using one or more road tubes. A small number of coverage counts are taken with Wavetronix SmartSensor 105 or SmartSensor 125HD digital radar sensor/recorders.

The Wisconsin Department of Transportation uses TRADAS®, a proprietary traffic data management, validation, summarization and archive software system developed by Chaparral System's Corporation, as the data management portion of the Wisconsin Traffic Monitoring System for Highways (WTMSH). This system is designed to process, validate and perform quality checks on traffic data, summarize the data to average daily, monthly, and annual statistics, store the data, generate reports, and prepare data for submission to federal agencies.

TRADAS® was designed to meet and exceed state and federal data processing requirements documented in the American Association of State Highway Transportation Officials' (AASHTO's) 2009 Guidelines for Traffic Data

Programs, Federal Highway Administration's (FHWA's) 2001 Traffic Monitoring Guide (TMG) and 2010 Highway Performance Monitoring System (HPMS) Manual.

The data in TRADAS© has multiple transportation uses for planning, project development, highway operations, maintenance, access, and more. Data collected also provides the source of information for traffic forecasting studies and projections.

In addition to the validation and quality checks in TRADAS©, additional short -duration count quality control processes are performed at, DMS Traffic Data Program. Two techniques used are:

1. Compare *preliminary* short-term AADT traffic count against historical AADTs to assess the historical pattern at that location. Counts +/- 20% of the previous AADT taken at the location are checked for accuracy. A preliminary traffic count +/- 20% of its historic AADT count does not mean the count is unreliable. The +/- 20% is a threshold used to indicate counts may need additional review.
2. Compare *preliminary* short-term AADT traffic counts along a roadway to see if possible problems with one or more traffic counts become visible.

DMS may request the Region re-count if:

- There are missing data or data gaps - data is required for each hour of a day
- Traffic volume equals 0 for all lanes for a specified number of consecutive hours
- Total volume in any lane for entire day equals 0
- Short duration counts with < 24 hours' of data
- Preliminary AADT traffic volume > +/- 20% of previous AADT

Recounts are considered special counts. Special counts aren't unusual. They are simply counts that fall outside of the regular count cycle. For example, the Traffic Forecasting Section may request a special count if a spot location is needed. Other units of WisDOT may also request special counts for specific purposes.

Regions typically request special counts for:

- Design projects
- Corridor studies
- Special event traffic
- Changes in traffic patterns
- Intersection analysis
- Origin-Destination studies
- Railroad Crossing studies
- Supplemental information

Traffic counts (coverage and special) are taken by region personnel. Collection of the annual field traffic data for the Region coverage count program includes:

- Scheduling coverage counts to meet program guidelines and avoid construction detours and road closures
- Installing portable automated traffic recording equipment at the locations depicted on the traffic count location maps to record traffic data

- Retrieving the traffic recording equipment after scheduled count duration and downloading data to PC disk to forward to Region/Central Office for processing and incorporation into statewide coverage count files.
- Re-taking incorrect or questionable counts to facilitate efficient operation and collection of representative traffic data.

B. Raw Counts

A “raw” count is the total number of vehicles recorded during whatever period of time the traffic data recorder was set to record data. Short duration counts (24 hours minimum, 48 hours recommended) require adjustments in order to convert the ‘raw’ count to an estimate of Annual Average Daily Traffic (AADT). Adjustments are applied to reduce the effects of temporal bias if the short duration count is to be used to estimate AADT.

Traffic counts were taken on WIS 23, from Fond du Lac to Plymouth, in 2005, 2008, and 2011 as part of the scheduled three-year count cycle. Additional mainline counts were requested by the Traffic Forecasting Section and taken in February of 2012. Based on Region perceived season/February count and equipment concerns, the Region Office conducted recounts in June of 2012.

TABLE 1 shows the raw mainline counts in the appropriate years, noting that some locations were not taken every year. See attached project location map showing raw data.

Count Site	Count Date	Count Date	Count Date	Count Date	Count Date
Fond du Lac County	June 2005**	August 2008	August 2011	Feb 2012	June 2012
201185		29492(May)	28989	25954	28837
200219	28048	27687	25933		26314
206104*	19930 (June) 16800(Aug)	20370	16361	16987	19712
200222	20277	20725	18849	17439	10437
200224	18011	18017	17797	16150	17559
Sheboygan County	April 2005**	July 2008	May 2011	Feb 2012	June 2012
590118	15114	9236	14723	14746	17142
591421	16292	11512	15658	15347	17909
590195	18573	12279	18411	17039	12557

TABLE 1 – Raw Count Numbers

* Two counts were taken at the same site because of the first count’s variance from the previous (2003) count. The second count, once factored, was closer to the previous AADT and used in the forecast.

** Coverage counts scheduled by county, not corridor, so the Sheboygan and Fond du Lac site counts were taken in different months.

The “raw” counts for Site 200222 and 590195 in June 2012 show an ‘atypical’ decrease in traffic volume counts. The lower traffic volumes reflected in July 2008 and June 2012 are a result of < 48 hours traffic data collected. The duration variability is addressed by the factoring process.

TABLES 1A and 1B illustrate the variation in raw counts when a count of less than 48 hours occurs.

Raw Counts	200222	%Change	Duration
6/2005	20,277		48 hr
8/2008	20,725	+2.21%	48 hr
8/2011	18,849	-9.05%	47 hr
2/2012	17,439	-7.48%	48 hr
6/2012	10,437	-40.15%	26 hr

TABLE 1A

Raw Counts	590195	% Change	Duration
4/2005	18,573		48 hr
7/2008	12,279	-33.89%	28 hr
5/2011	18,411	+49.94	48 hr
2/2012	17,039	-7.45%	48 hr
6/2012	12,557	-26.30%	28 hr

TABLE 1B Note: Short-term traffic data require a minimum of 24 hours.

Variables

Traffic counts fluctuate due to many variables. Some variables are unpredictable and hard to account for in raw data, such as equipment set-up variations, equipment failure, inclement weather conditions, and traffic incidents/crashes. Region personnel will often make note of any extenuating circumstances during the counts in their field notes. Re-counts or special counts may be taken if equipment failure or other such variables are suspected.

More predictable variables include the following:

- Counts are taken by county in different months of the year, usually April to September to optimize seasonal weather conditions.
- Counts are taken on different days, usually weekdays between Monday noon and Friday noon
- In addition, while typical counts are 48 hours long, counts may be taken for varying lengths of time.

To account for these variables, raw counts are factored using the system described below.

C. Factors and Factored Counts

Annual average daily traffic (AADT) is an estimate of traffic volume passing a specific location on an "average" day. Raw counts are factored in order to generate an AADT estimate.

The formula used to convert 'raw' counts to a 'factored' count, or annual average daily traffic (AADT), for short-duration traffic volume counts is:

$$AADT = VOL * M * D * P * A \text{ (if needed)}$$

AADT = the annual average daily travel at location

VOL = the 24-hour or 48-hour volume at location

M = the applicable seasonal (monthly) factor for factor group

D = the applicable day-of-week factor for factor group

P = the applicable pulse factor to convert vehicle to axle counts

A = the applicable axle-correction factor for location (if needed)

This formula is modified as necessary to account for the traffic count's specific characteristics. For example, if the short duration count is taken with two pneumatic axle tubes to capture classification, the axle correction factor (A) is removed from the formula.

Seasonal (Monthly) Factors

Monthly factors are used to correct for seasonal bias in short duration counts.

Day-of-Week Factors

Day-of-week factors are needed to estimate AADT if the period of monitoring for a short duration count does not account for the differences in travel by day of week.

Pulse Factors

Represents a device's relatively crude estimate of how many axles belong to a single vehicle.

Axle Correction Factors

The application of axle correction factors is dependent on the type of equipment in use. Equipment that detects vehicles directly (such as inductance loops or vehicle classification counters), do not require axle adjustment.

Seasonal and day-of-week factors based on continuous volume data collected in the same year as the short-term counts is used to compute the *final* AADT. Seasonal and day-of-week factors based on the previous year's continuous volume data are used to compute the *preliminary* AADT. Axle correction factors based on current year continuous and short-term classification data are used in computing the *final* AADT if needed. Axle correction factors based on the previous year's continuous and short-term classification data are used to compute the *preliminary* AADT.

TABLE 2 below shows the results of Table 1 with the factors applied to the raw count date by site. See attached project location map showing factored data.

Count Site	Factored Count Date	Count Date	Count Date	Count Date	Count Date
Fond du Lac County	June 2005	August 2008	August 2011	Feb 2012	June 2012
201185		12505	12544	10848	12181
200219	11431	11731	11219		11115
206104	8365 7806	9507	7870	7452	8802
200222	8596	8838	8525	7650	8784
200224	7634	7684	7791	7084	8081
Sheboygan County	April	July	May		
590118	6992	7043	6674	6434	7643
591421	7353	7404	7347	6695	7984
590195	8582	8380	8118	7439	9516

TABLE 2 – Factored Count Numbers

Historical Pattern Comparison

Comparing site specific traffic count locations against historical counts, counts fall within an acceptable +/- 20% threshold with the exception of 206104 August 2008 and 591421 June 2012 counts.

Roadway Pattern Comparison

Comparing traffic count locations along WIS 23 between Sheboygan and Fond Du Lac, counts fall within an acceptable +/- 20% threshold with the exception of 591421 June 2012 count.

DMS reviews the factored counts for consistency, using a plus or minus variance of 20 percent as a guideline. If a single location is out of normal range, that location may be checked to determine if there was an equipment failure, construction nearby, a poor location or other issues. As an example, the Table 3 illustrates changes in the AADT counts. It can be seen that site 206104 is above the 20% threshold for the 2008 count. This site was counted twice in 2005 and it appears the second count was chosen because it was closer to the previous (2003) AADT of 7500 vehicles (4.1% increase). The first count taken in 2005 was an increase of 11.5% over the 2003 AADT. Likewise, the change for the June 2012 count at site 591421 is above the 20% threshold, but since the adjacent sites are within the threshold, and show similar changes, the count is acceptable. The AADT counts for June 2012 were considered reliable and forwarded to TFS for forecast development. (Note: Even if DMS considers the AADT counts reliable, TFS or Region could still question the count fluctuation and request a recount.)

TABLE 3 below shows the percent change in factored counts.

	AADT 2005	AADT 2008	% Change 2008 - 2005	AADT 2011	% Change 2011 - 2008	AADT 2012- Feb	% Change 2012(Feb) - 2011	AADT 2012- June	% Change 2012(June) - 2011
201185		12,505		12,544	0.31%	10,848	-13.52%	12,181	-2.89%
200219	11,431	11,731	2.62%	11,219	-4.36%			11,115	-0.93%
206104	8,365 7,806	9,507	21.79%	7,870	-17.22%	7,452	-5.31%	8,802	11.84%
200222	8,596	8,838	2.82%	8,525	-3.54%	7,650	-10.26%	8,784	3.04%
200224	7,634	7,684	0.65%	7,791	1.39%	7,084	-9.07%	8,081	3.72%
590118	6,992	7,043	0.73%	6,674	-5.24%	6,434	-3.60%	7,643	14.52%
591421	7,353	7,404	0.69%	6,383	-13.79%	6,695	4.89%	7,984	25.08%
590195	8,582	8,380	-2.35%	8,118	-3.13%	7,439	-8.36%	9,516	17.22%

TABLE 3

-It is standard procedure to apply factors to compute preliminary AADT based on prior year data. Final AADTs are not available until Annual Processing has been completed, typically by April or May.

-2010 factors were applied to the February 2012 counts (2011 factors were not available since Annual Processing was not complete)

-2011 factors were applied to June 2012 counts

II. Traffic Forecasting

A. Standard Practice

Highway traffic forecasting is the process of estimating the number of vehicles that will use a specific roadway in the future. Traffic forecasts report conditions predicted in a roadway design year (usually 20 years after anticipated construction) or in a long-range plan projection year. As per WisDOT Facilities Development Manual (FDM) Section 3-10-10, federal and state-funded projects require traffic forecasts (projections) performed and/or approved by TFS. Forecasts are prepared and approved centrally to assure that a consistent methodology is utilized for all forecasts in Wisconsin.

The TFS is the overall WisDOT business area lead in forecasting travel and conducting future travel analysis. TFS uses a standard, multi-step traffic forecasting process and procedure to develop roadway traffic forecasts. Usually, WisDOT conducts forecasts at least twice during the life cycle of a project; once during planning and then during data gathering stage of final design.

B. Methodology

WisDOT uses the best forecasting tools and data available at a particular time to conduct traffic forecasts. It is WisDOT policy to use the Traffic Analysis Forecasting Information System (TAFIS) alone to conduct roadway traffic forecasts in all areas of Wisconsin where no travel demand model exists, and to use a combination of the

TAFIS outputs and travel demand model outputs together to conduct the traffic forecasts where travel demand models do exist.

Developed in 2001, the TAFIS computer program compiles historic traffic volume information and other data at a specific state trunk highway traffic count site and then performs a Box-Cox regression in order to predict future traffic at that site. WisDOT has programmed TAFIS as a series of prediction techniques that produce results based on data conditions at or surrounding each traffic site. TFS periodically runs a set of business rules to update the TAFIS to gather traffic counts from the relational database and from TRADAS. TAFIS does not take into account classification data, roadway number of lanes or land use development patterns to predict traffic volumes.

The Northeast Travel Demand Model is another forecast tool. Like all travel demand models and unlike TAFIS, this tool uses current socio-economic data, roadway networks, trip rates and other factors to calculate current and future travel patterns. Travel demand models analyze future land use development scenarios to predict how and where future roadway traffic will go. The Northeast Travel Demand Model is based on a classic four-step process that consists of trip generation, trip distribution, mode choice and traffic assignment.

TABLE 4 below shows all the area forecasts since 2001 and the tools used to produce them.

Forecast Date	WIS 23 Location (From – To)	Used NE Travel Demand Model?	Used TAFIS?
7/28/2005	County K – East of WIS 67	No	Yes
2/16/2006	US 151 – County UU	No	Yes
9/20/2007	West of Branch Rd – Chicago/NW Railroad (1 site only)	No	Yes
5/25/2010	US 151 – WIS 67	No	Yes
11/4/2010	WIS 23 at County G (Turning Movement Forecast)*	No	Yes
1/10/2012	US 151 – WIS 67	Yes	Yes
2/9/2012 and 3/5/2012	US 151 – WIS 67	Yes	Yes
7/8/2012	US 151 – WIS 67	Yes	Yes

TABLE 4 – WIS 23 Corridor Traffic Forecasts and Forecasting Tools

* Note: For the 11/4/2010 forecast, traffic counts were derived from turning movement data (not TRADAS). See attached forecasts for count dates.

Table 4 outlines all of the WIS 23 Traffic Forecasts since 2001 and the forecasting tools that were used to produce results. Before 2011, a travel demand model did not exist on this corridor for the Northeast Region, so forecasts (including the 7/28/2005 Forecast) did not consider travel demand model results. These forecasts and others using only TAFIS can also be referred to as an “unconstrained” output of one of the prediction techniques. After 11/2011, traffic forecasts were produced using the NE Travel Demand Model. The 2012 forecasts can also be referred to as “constrained” forecasts, because the travel demand model reports the amount of future traffic the roadway system can handle.

Therefore, TAFIS and the Northeast Travel Demand Model are generated with different information at their core. WisDOT policy is to compare travel demand model growth rates with the TAFIS growth rates using several techniques. The travel demand model growth rate accounts for anticipated changes in population and employment in specific locations. Regression-based TAFIS growth rates are based on formulas that are applied to the past and current traffic counts on each count site, with little to no intelligence behind the assumption as to why changes into the future will occur. Because of this, TFS documents differences in growth rates before choosing them in traffic forecasts. Also, sound and logical judgment are used to determine if the applied growth rate makes sense intuitively.

When the travel demand model forecast produces a future forecast year volume greater than 10% over the TAFIS future forecast year volume, a compromise number is reached. The compromise number should generally be the edge of the accepted 10% range in TAFIS, as long as it is also within 10% of the travel demand model forecast volume. This is because travel demand models, like the Northeast Travel Demand Model, generally have better information regarding future growth patterns than TAFIS. If poor calibration in the model is suspected, the TAFIS growth rates would hold as likely producing a better forecast value. Therefore, the decision was made to insure that forecasted volumes in the Northeast Travel Demand Model and TAFIS were to be within 10% of each other.

If an adjustment in growth rates is necessary, a note is made explaining the reason for the difference between TAFIS and the Travel Demand Model. The basis for this policy is present in a document entitled “Criteria for Accepting or Overriding a WIS System Traffic Forecast with an Urban Travel Demand Model” which can be found in the Miscellaneous Section of the 1991 Travel Demand Forecasting and Analysis Handbook produced by the WisDOT’s Traffic Forecasting Section (TFS).

In the spring of 2012, a post-processing script was added to the Northeast Travel Demand Model forecasting procedure that made it easier to gather up the most recent traffic volumes out of the TAFIS system link them to traffic segments in the travel demand model. Thus, automating a process that at one time was conducted by the traffic forecaster verifying each data point. This slight change to the ‘read of data’ improves model comparisons to TAFIS overall and should have had no change to the model outputs or to the forecasting methodologies used. It just made things easier for the traffic forecaster.

C. Forecasts Using WIS 23 AADT’s

As Table 4 indicated earlier, several forecasts have been conducted on WIS 23. The Draft Environmental Impact Statement for WIS 23 was completed in 2004. As the study moved into the FEIS stage, an updated forecast was requested by the NE Region using the short-term tri-annual 2005 AADT counts. TFS used TAFIS to conduct the traffic forecast using historic counts and a standard Box-Cox regression analysis. Manual adjustments to the TAFIS outputs were made, and the 7/28/2005 forecast was produced.

TABLE 5 shows the results of the 7/28/2005 No Build Forecast using 2005 AADT Counts.

Location Year	Count 2005	Forecast 2036
201185	11425	18600
200219	8600	13025
206104	8200	12525
200222	8600	16050
200224	7625	12400
590118	9150	14900
590195	9525	17375

TABLE 5 – 2005 AADT Count, 7/28/2005 No Build Forecast

In January 2012, an updated forecast was requested for the WIS 23 Supplemental Environmental Impact Statement. The forecast was completed using the short-term tri-annual 2011 factored counts. The Northeast Region Travel Demand Model (latest version fall 2011), and TAFIS were used to develop the forecast on January 10, 2012. Normal procedure was followed to update traffic forecast information. As mentioned before, forecasting tools had evolved since 2005. The 2005 forecast did not utilize a travel demand model output, but the 2012 traffic forecasts used both the model and TAFIS. Another issue that can affect forecast results and affected them here involves traffic counts. Traffic counts had not grown significantly since 2005, but had gone down or remained steady. Count information changes the results of the Box-Cox regression analysis inside TAFIS. Rather than increasing, growth rates leveled off. Steady traffic counts also meant that the most recent count that the travel demand model would start from before it is run, would be from a lower starting point when it uses the most up-to-date traffic counts in its analysis.

TABLE 6 shows the results of the 1/10/2012 No Build Forecast using 2011 AADT Counts.

Location Year	Count 2011	Forecast 2035
201185	11100	16300
200219	10000	11700
206104	7600	9300
200222	7300	8500
200224	6700	7500
590118	5800	6600
590195	7100	7800

TABLE 6 – 2011 AADT Count, 1/10/2012 No Build Forecast

III. Evaluation and Validation

The 2011 AADT count, 1/10/2012 No Build forecasts were much lower than the 2005 AADT count, 7/28/2005 No Build forecasts. A meeting was conducted in late January 2012 between the WisDOT Region project team, the TFS and the East Central Regional Planning Commission to discuss concerns and exchange information. As a result of this meeting, and at the request to verify the data was correct, the TFS requested that new traffic counts be taken and another forecast prepared. Special counts (not part of the three year cycle) were taken in early February 2012, due to good winter weather conditions.

Special counts are not unheard of. WisDOT requires the use of the most recent factored average annual daily traffic count to develop traffic forecasts and will collect new traffic counts when the most recent count is older than 3-years old. If no traffic counts exist, the Region is advised to collect new traffic counts before sending in a traffic forecast request to the TFS. As the forecast begins to be developed, the TFS uses the same 20% guideline that DMS uses to verify traffic counts. If a traffic count seems to be out of the range of the 20% guideline, TFS will verify with DMS, who will then, usually, verify with the WisDOT Region if the traffic count seems reasonable.

As a result of the February 2012 traffic counts, TFS developed a new set of forecasts dated 2/9/2012 and 3/5/2012 using the NE Region Travel Demand Model and TAFIS. These forecasts took the forecasting process a step further, by changing the geometry within the travel demand model to show the respective alternatives for the proposed WIS 23 project. The forecasts clearly indicated the “no build” and “build” alternatives and other alternative types that are considered in the supplemental EIS.

TABLE 7 shows the result of the Central Office 2/9/2012 and 3/5/2012 No Build and Build Forecasts using February 2012 AADT Counts .

Site ID	February 2012 Counts	2035 No Build	2035 Passing Lane w/o Left Turn Lanes	2035 Passing Lane w/Left Turn Lanes and Median Refuges	2035 Hybrid 4-lane to CTH G Passing Lane CTH G to CTH P	2035 4-Lane Build on Alignment
201185	10484	15700	14600	14600	14900	17600
200219	9455	11000	11800	11800	12300	13400
206104	7452	9100	9600	9600	10200	11200
200222	7650	8900	9900	9900	10500	10800
200224	7084	7900	8700	8700	9400	9500
590118	6434	7200	7500	7500	8300	8800
590195	7439	8200	8400	8400	9100	9600

TABLE 7 – 2012 AADT Count, 2/9/2012 and 3/5/2012 No Build and Build Forecasts

Constrained Forecast Produced with Travel Demand Model and TAFIS - As a result of the statistical analysis conducted, any official forecast produced will not necessarily match outputs of either TAFIS or the travel demand model directly. The Northeast Travel Demand Model was completed for forecasting purposes in this area of the state, in Fall 2011. Forecasts completed 2/9/2012 and 3/5/2012. Note: Whether or not left turn lanes are built does not affect the passing lane forecast results as long as it is not divided and the posted speed remains the same.

The February forecasts were higher than the January forecasts. The Region had concerns about the traffic counts used to develop the forecast. One concern was that counts are not normally taken during winter months to avoid snow and other inclement Wisconsin weather. The Region staff wondered if, even with seasonal factors applied, we were comparing like counts to the coverage counts used in the January forecasts.

A second concern was regarding the hose counts. New equipment was purchased between the 2005 forecasts and the 2012 forecasts. The Timemark Delta NT counters/hoses recorded only time tagged axle counts and were considered easy to set up in the field. Typically hose counters are laid across the entire roadway and are activated when a vehicle crosses them. On a similar project, counts were taken in 2010 and again in 2012 with a different hose configuration and different results. The new configuration included a “knot” in the hose that enabled the traffic crossing the hose simultaneously in opposite directions to be counted as two vehicles, not just one as previously done. It was believed that the new configuration would correct what was thought to be an “error” in the earlier WIS 23 traffic counts.

Special counts were taken in June 2012 with the new hose configuration. TFS developed a 7/8/2012 forecast using the NE Region Travel Demand Model and TAFIS. Forecasts showed reasonable results.

Table 8 shows the result of the TFS 7/8/2012 No Build and Build Forecasts (June 2012 AADT Counts).

Site ID	June 2012 Counts	2035 No Build	2035 Passing Lane w/o Left Turn Lanes	2035 Passing Lane w/Left Turn Lanes and Median Refuges	2035 Hybrid 4-lane to CTH G Passing Lane CTH G to CTH P	2035 4-Lane Build on Alignment
201185	12181	17400	16000	16000	16300	17000
200219	11115	12300	13100	13100	13600	14200
206104	8802	10800	11000	11000	11500	11900
200222	8784	9500	11000	11000	11500	11900
200224	8081	9100	9700	9700	10400	11000
590118	7643	8500	9100	9100	9400	10200
590195	9516	10400	10700	10700	11200	12000

TABLE 8 – June 2012 Count, 7/8/2012 No Build and Build Forecasts

As the Region continued to investigate the traffic count fluctuations and forecast variations, concerns about the February counts were addressed. First, with seasonal factor applications, DMS found the February and June counts to be reasonable and within normal traffic fluctuations (within the plus or minus 20% range). Second, there are several plausible reasons for count variations, including different hose configurations. Because WIS 23 within the project limits was nearly all rural roadway with no stop conditions, there was little likelihood that enough traffic crossed the hose simultaneously in opposite directions to noticeably affect the traffic counts. Based on further information and discussion with DMS, the count differences were likely due to normal variations and not a specific error.

IV. Conclusion

Standard practices in data requests, data collection and data quality were performed during the entire Wis23 evaluation.

The 2005 and 2012 traffic forecast variances were due to the difference in forecasting tools available at the time the forecasts were completed. The differences are also due to traffic counts holding steady and not growing at a large rate over the course of the past several years. The 7/8/2012 No Build and Build Forecasts are what TFS would consider reasonable based on the data available, standard practice and forecasting technique.

The July 8, 2012 No Build and Build Forecasts from the June AADT counts are the most current data available for the project. WisDOT uses the most current data available in our projects. This information will be incorporated into the supplemental EIS and be considered, along with the other purpose and need criteria, when evaluating alternatives.

APPENDIX LS-B
PURPOSE AND NEED SCREENING TECHNICAL MEMO

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Project ID 1440-13/15-00

Wisconsin State Highway 23
Fond du Lac to Plymouth
Fond du Lac and Sheboygan Counties, Wisconsin

Purpose and Need Screening Evaluation
Technical Memo

August 21, 2012



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Introduction

Background

A Draft Environmental Impact Statement (DEIS) was released for WIS 23 from Fond du Lac to Plymouth in November 2004. Figure 0-1 shows the approximately 19.5-mile corridor limits. The DEIS evaluated alternatives that addressed system, capacity, and safety needs on this corridor. Because of changes and additions to the project, a Supplemental Draft EIS (SDEIS) was released in December 2009, followed by a Final EIS (FEIS) released in June 2010. The Federal Highway Administration (FHWA) issued a Record of Decision (ROD) on September 27, 2010. The ROD provided for the 4-lane expansion of WIS 23 from Fond du Lac to Sheboygan as well as the construction of several interchanges and the extension of a multiuse trail.

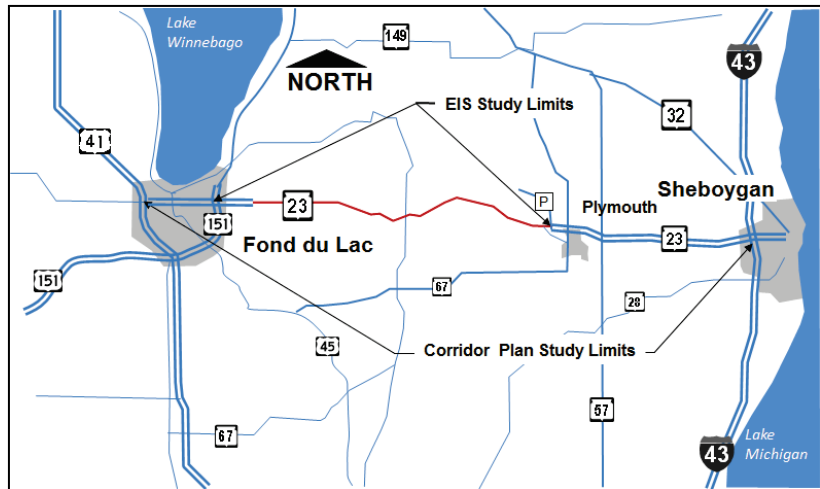


Figure 0-1 Project Location

Since the time of approval, Wisconsin Department of Transportation (WisDOT) has been purchasing right of way along the corridor. Some right of way was previously purchased before the ROD through the hardship acquisition process.¹

Since the time of approval, Wisconsin Department of Transportation (WisDOT) has been purchasing right of way along the corridor. Some right of way was previously purchased before the ROD through the hardship acquisition process.¹

WisDOT, in partnership with the FHWA, seeks to prepare a Limited Scope Supplemental Environmental Impact Statement for the study according to Title 23, Part 771.130 (f) of the Code of Federal Regulations (23 CFR 771.130). The applicable text states:

§ 771.130 Supplemental environmental impact statements.

(f) In some cases, a supplemental EIS may be required to address issues of limited scope, such as the extent of proposed mitigation or the evaluation of location or design variations for a limited portion of the overall project. Where this is the case, the preparation of a supplemental EIS shall not necessarily:

- (1) Prevent the granting of new approvals;*
- (2) Require the withdrawal of previous approvals; or*
- (3) Require the suspension of project activities; for any activity not directly affected by the supplement. If the changes in question are of such magnitude to require a reassessment of the entire action, or more than a limited portion of the overall action, the Administration shall suspend any activities which would have an adverse environmental impact or limit the choice of reasonable alternatives, until the supplemental EIS is completed.*

The Supplemental EIS (SEIS) will be used to address issues of Limited Scope associated with the overall project. These issues include:

- Updating data that is no longer valid in the original project purpose and need.
- Enhancing and clarifying the discussion of alternatives that do not include capacity expansion.

¹ On prolonged studies, property owners may be eligible for hardship acquisition. Affected property owners may make a formal request to WisDOT to purchase their property as a "hardship." The owner must show that the marketability of the property has been adversely affected by the proposed plan and that a prolonged delay in the acquisition will cause them undue economic hardship. Once WisDOT receives such a request, WisDOT considers the request and follows the procedures for Early and Advanced Acquisitions in accordance with the WisDOT Real Estate Program Manual (WisDOT, August 2012, https://trust.dot.state.wi.us/extntgtwy/dtid_real_estate/repm/repm.htm).

- Enhancing and clarifying the discussion of impacts to Section 4f resources.
- Updating and clarifying the Indirect and Cumulative Effects (ICE) analysis.

Purpose of this Memo

The 2010 FEIS had several paragraphs describing existing and projected traffic volumes as well as the resulting traffic operation from those volumes. Since the completion of the 2010 FEIS, a Travel Demand Model was developed for the Northeast Region that expands the ability of WisDOT to model network changes. The model results were used along with current traffic data and linear regression techniques to develop revised 2035 forecasts for the SEIS. Lower traffic volumes on roadways throughout the state influence future traffic forecasts and in most cases have made them lower. In March 2012, WisDOT prepared traffic forecasts for WIS 23 for the year 2035 using traffic counts performed in 2011 and 2012. They were lower than those presented in the 2010 FEIS and those used in the initial alternatives screening.² Additional traffic counts were performed in June of 2012 to address some equipment malfunctions that occurred with the 2011 and 2012 traffic counts. The June traffic counts were also performed to determine if lower traffic volume trends were continuing as economic conditions were improving throughout the state. Traffic forecasts performed in July of 2012 using these counts are similar to those presented in the 2010 FEIS though still lower. These lower forecast volumes may make alternatives that were initially screened from consideration appear viable today.

Screening criteria are used to determine whether alternatives satisfy the project purpose and need. The screening criteria are directly linked to the project purpose and need stated in the 2010 FEIS.

This technical memo evaluates whether the alternatives that were eliminated from detailed study in the initial EIS process because they did not satisfy the project purpose and need could now be viable as a result of changed conditions. If these alternatives continue to not satisfy the project purpose and need, WisDOT and FHWA will continue to move forward with the Limited Scope SEIS. If the previously eliminated alternatives, as a result of current conditions, are now determined to satisfy the project purpose and need, WisDOT and FHWA will prepare a full SEIS and activities on the project will be suspended until the SEIS is completed.

Current Alternatives Under Consideration

The DEIS, SDEIS, and FEIS evaluated various alignments for WIS 23, many of which included an off-alignment 4-lane expansion of the WIS 23 corridor. These options are described more fully in the DEIS, SDEIS, and FEIS for the project. The off-alignment alternatives³ were dismissed from consideration as the preferred alternative because of their high environmental and socioeconomic impacts. The reasons for their elimination remain and do not require reevaluation. The on-alignment alternatives are influenced by reduced traffic volumes and traffic forecasts. Less traffic may increase the ability of previously dismissed on-alignment improvement alternatives to satisfy the project purpose and need. An example would be the provision of passing lanes instead of 4-lane expansion. With lower 2035 traffic forecasts, passing lane alternatives may be able to provide acceptable operation levels, which would help those alternatives satisfy the project purpose and need.

The following paragraphs briefly describe the alternatives being evaluated in this technical memo on their ability to satisfy the project purpose and need.

² Appendix A contains a technical memo that describes how the WIS 23 corridor traffic forecasts have been affected by reduced traffic volumes.

³ Referred to as Segments A through E and Alternatives 2, 3, 4, 5 and 6 in the FEIS.

A. No-Build

The No-Build alternative involves the continued use of the existing WIS 23 without reconstruction or enhancements of the existing roadway. By definition, the No-Build alternative may include minor restoration types of activities that maintain the

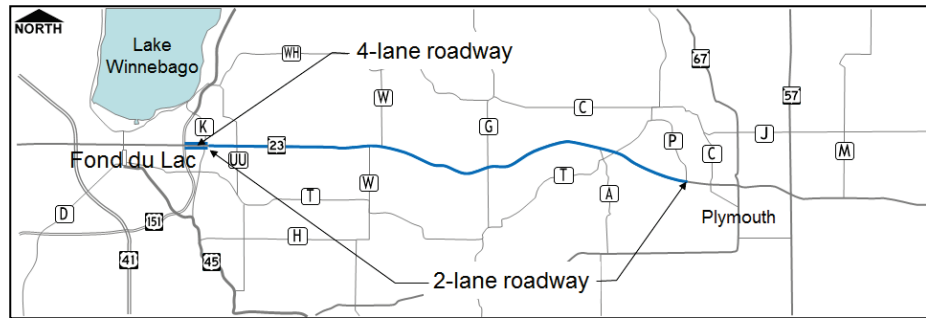


Figure 0-2 No-Build Alternative

same typical section and alignment of the highway.

WIS 23 would remain a 4-lane roadway for the western 1.3 miles from US 151 to 0.4 miles east of County K. It would be a 2-lane roadway for the remaining 18 miles to the end of the study limits. In the June 2010 FEIS, the No-Build alternative included a mill and overlay pavement maintenance project. The No-Build alternative serves as the basis for comparison of other alternatives. If the No-Build alternative were selected, other smaller WIS 23 projects could be evaluated in subsequent National Environmental Policy Act (NEPA) documents and implemented if appropriate.

B. Passing Lane Without Left-Turn Lanes

Passing lane alternatives were evaluated by WisDOT in a report prepared in May 2006. While WIS 23 is not currently part of the state plan for corridors with passing lanes, current traffic forecasts indicate design-hour volumes fall within the thresholds where passing lanes could be considered. WisDOT has criteria for locating passing lanes to provide optimal operational benefits as found in WisDOT's Facilities Development Manual (FDM) 11-15-10. A corridor that is being considered for passing lanes should be approximately 15 to 50 miles in length. The roadway must be a 2-lane rural highway; the passing lane must be placed where passing opportunities are limited because of traffic volumes, roadway alignment, or high proportion of slower vehicles. Passing lane placement should also acknowledge guidelines found in FDM 11-15-10.1.2.⁴

The Passing Lane Without Left-Turn Lanes alternative adds 4 passing lanes, 2 for eastbound travel and 2 for westbound travel in addition to the existing two climbing lanes west of County P in Sheboygan County. The distance between the successive westbound passing lanes is 4.3 miles; the distance between the successive eastbound passing lanes is 6.6 miles. Each passing lane is 12 feet wide with an 8-foot shoulder, of which 6 feet is paved.

The Passing Lane Without Left-Turn Lanes alternative would upgrade side-road intersections with the appropriate intersection type in WisDOT's FDM. These intersection improvements, however, would not provide left-turn lanes on the WIS 23 highway. By not installing left-turn lanes, the amount of roadway available for passing is increased. A new jug-handle intersection would be provided at County K to address the higher crash frequency and traffic volumes at this intersection. The jug-handle has a grade separation with bridges to carry WIS 23 over County K. West of County K, traffic would have on and off access to WIS 23 using dedicated lanes. The access would be right-in/right-out, which eliminates dangerous crossing and left-turning maneuvers. Figure 0-3 schematically illustrates passing lane placement and the location of the County K jug-handle while Figure 0-4 illustrates the typical section through a passing lane segment.

⁴ Facilities Development Manual 11-15-10 (WisDOT, December 30, 2002; <http://roadwaystandards.dot.wi.gov/standards/fdm/11-15.pdf>)

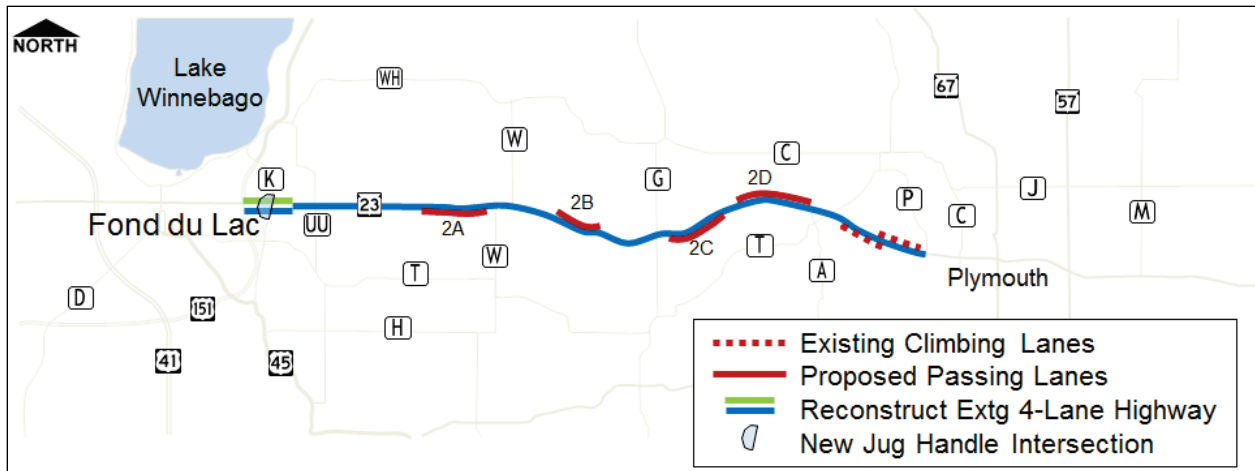


Figure 0-3 Passing Lane Without Left-Turn Lanes Alternative

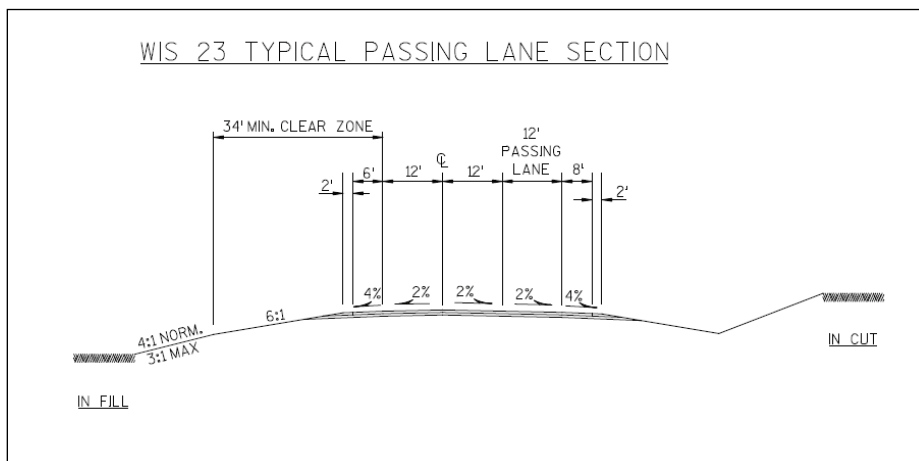


Figure 0-4 Passing Lane Typical Section

C. Passing Lane With Left-Turn Lanes

The Passing Lane With Left-Turn Lanes alternative has all the characteristics as the previously described alternative except that it adds a left-turn lane for WIS 23 traffic at higher volume intersections. FDM 11-25-5⁵ provides warrants for the installation of left-turn lanes on rural highways based on the traffic volumes of the mainline and the side road. Even though most WIS 23 side road intersections do not have traffic volumes that warrant the installation of left-turn lanes, this alternative includes left-

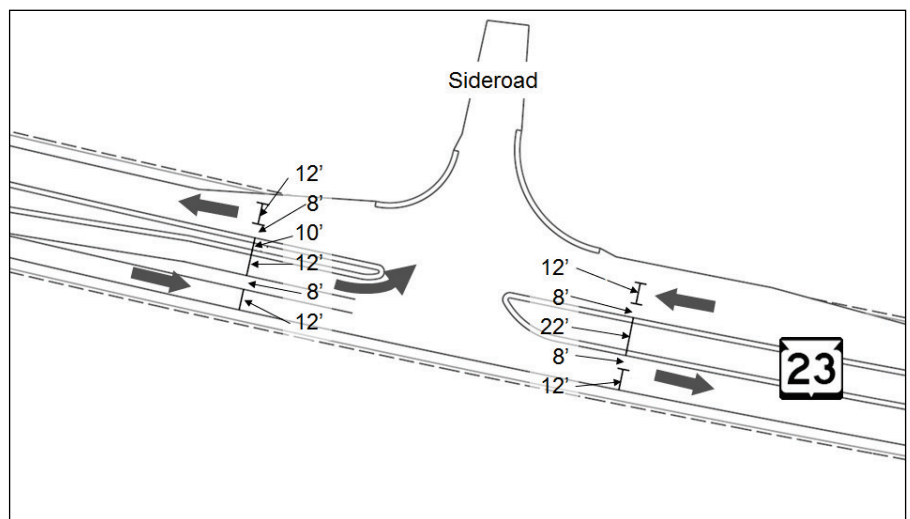


Figure 0-5 Typical Left-Turn Layout

⁵ Facilities Development Manual 11-25-5 (WisDOT, February 25, 2011; <http://roadwaystandards.dot.wi.gov/standards/fdm/11-25.pdf#fd11-25>)

turn lanes because they provide a safety feature. The left-turn lane provides a refuge for left-turning vehicles removing them from exposure to the through travel stream. Adding the left-turn refuge requires the development of a median for 0.2 miles on both sides of the side-road intersection, which decreases the amount of roadway that is available for passing. Figure 0-5 illustrates a typical configuration of a WIS 23 T-intersection with a left-turn lane and associated median; the median associated with the left-turn lane also provides a median refuge for side-road vehicles crossing or making a left onto WIS 23.

D. Hybrid 4-Lane to County G, Passing Lane County G to County P

The Hybrid alternative was developed during the formation of alternatives for the Limited Scope SEIS to assess the potential to satisfy the project purpose and need with the revised and lower traffic volume forecasts. It provides a 4-lane divided highway for 11.5 miles from US 151 in Fond du Lac to County G. A jug-handle intersection would be provided at County K. Diamond interchanges would be provided at County UU and County G. East of County G, WIS 23 would be a 2-lane roadway with passing lanes for the remaining 8 miles. Figure 0-6 schematically illustrates this alternative.

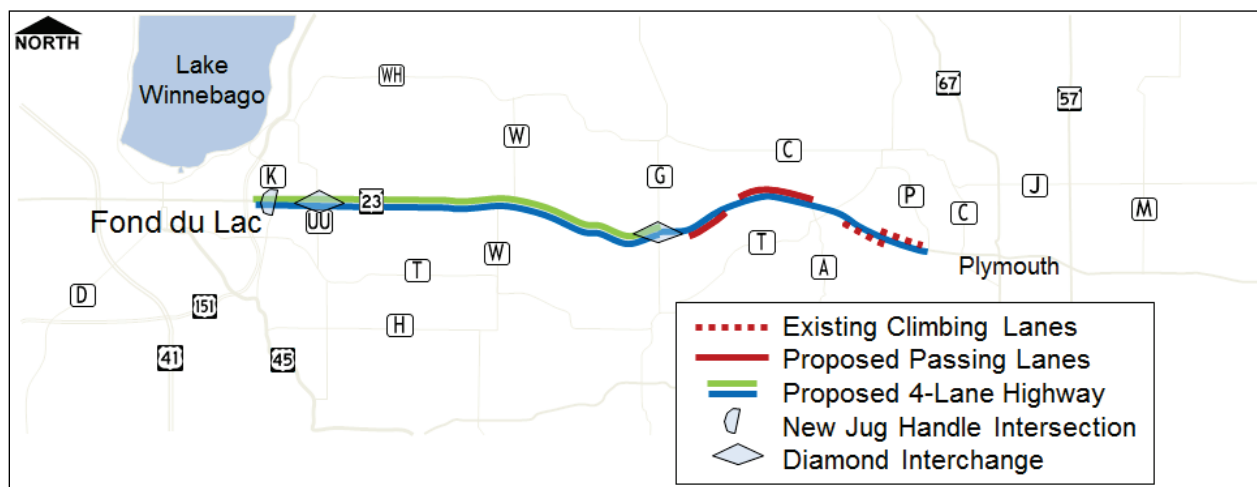


Figure 0-6 Hybrid 4-Lane to County G, 2-Lane County G to County P Alternative

E. 4-Lane Build On-Alignment

The 4-Lane Build On-Alignment Alternative evaluated in this technical memo was the Preferred Alternative described in the 2010 FEIS and ROD. This alternative would provide a 4-lane divided highway on the existing alignment for the full length of the project. For the 2-mile section from US 151 to County UU, WIS 23 would have a high-speed urban cross section. This includes four 12-foot lanes, 6-foot inside shoulders, 10-foot outside shoulders, and an 18-foot median with mountable curb. The outside edges use either a rural section with a ditch or a suburban section with mountable curb and gutter.

From County UU east to County P in Sheboygan County, WIS 23 would have a typical expressway cross section with a design speed of 70 mph. This includes four 12-foot lanes, 6-foot inside shoulders, 10-foot outside shoulders, and a 60-foot median.

A jug-handle intersection would be provided at County K; diamond interchanges would be provided at County UU, County G, and County P. Of the 40 intersections, J-Turns are proposed at 6 high volume intersections. J-Turns are being proposed at 7 Hills Road, County W, County U, Sugarbush Road, County A, and County S. This intersection concept only allows right-in/right-out/left-in movements and removes the most hazardous left-out and through movements from the intersection. Drivers from the side road that want to turn left onto WIS 23 or travel through on the side road must take a right and then make a U-turn at an appropriate distance from the intersection. This type of intersection has been successfully used in several states to improve intersection safety and was a recommended measure for this project based on a road safety audit. A J-Turn can only be installed on 4-lane divided highways because the

radius needed for a large truck to make a U-turn is too great to install on a 2-lane roadway that does not have a median. This concept is shown in Figure 0-7.

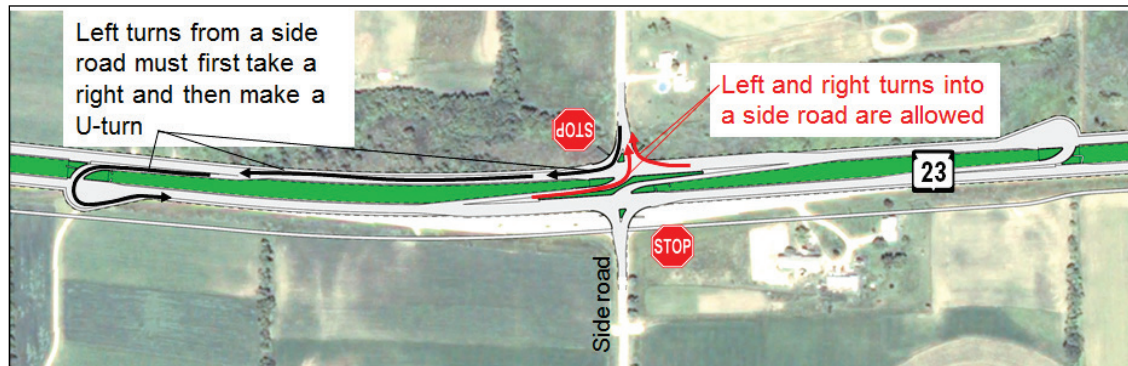


Figure 0-7 J-Turn Concept

F. Other Features

All the alternatives, except for the No-Build alternative, would officially map lands needed for future transportation improvements, such as overpasses and interchanges. The official mapping would be implemented through the freeway designation and corridor preservation provisions of Wisconsin State Statute 84.295. Improvements that would be officially mapped include interchanges at County W north and County A as well as overpasses at Tower Road, 7 Hills Road, Scenic View Drive, and Sugarbush Road. The Passing Lane alternatives would also preserve right of way for the future 4-lane expansion as well as interchange at County UU, G, and P. Local road improvements/reroutings would be officially mapped.

All the build alternatives have the opportunity to provide bicycle accommodations either through a wide paved shoulder or through the extension of the Old Plank Road Trail, a multiuse path. WisDOT incorporated this extension in the 2010 FEIS Preferred Alternative in response to existing bicycle plans and actions made by local governments. About 2.5 miles of the existing Old Plank Trail already exists within the project limits.

The Passing Lane alternatives as well as Hybrid alternative could include the extension of the Old Plank Road Trail by constructing a trail from where it currently ends near Greenbush. It would be extended 17 miles west to the Prairie Trail in Fond du Lac. Figure 0-8 schematically illustrates the location of the proposed Old Plank Trail extension. In order for the Passing Lane alternatives to include the trail extension, they would need to purchase additional right of way. Also, the trail would either be built in its ultimate location (based on future 4-lane design) or would need to be relocated if future 4-lane expansion occurs. The trail would cross WIS 23 using an at-grade intersection when switching from the south side to the north side at County UU.

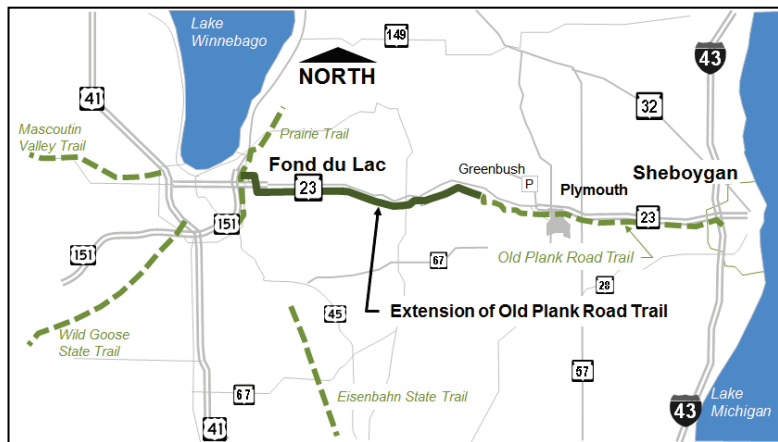


Figure 0-8 Old Plank Road Trail Extension

The 4-Lane Build On-Alignment would include the extension of the Old Plank Road Trail in the location described in the Passing Lane alternatives. Because this alternative is a full 4-Lane alternative, the trail would be built in its ultimate location. Also, because the 4-lane Build On-Alignment includes an interchange at County UU, it provides a grade-separated crossing of WIS 23 where the trail switches from the south side of WIS 23 to the north side of WIS 23 for bicyclists using the trail.

The remainder of this technical memo provides a discussion of the factors within the purpose and need and develops screening criteria for the evaluation of alternatives. If the alternatives satisfy the screening criteria, they satisfy that component of the project purpose and need.

Purpose and Need Criteria Discussion

1. System Linkage and Route Importance

The **2010 FEIS project purpose** objectives for the proposed action that pertain to purpose and need criterion 1 include the following:

- *Provide a safe and dependable highway connection to and from regional communities...*
- *Provide system continuity between the City of Sheboygan and the City of Fond du Lac. WIS 23 is a major east-west connecting highway between these population centers of east central Wisconsin.*

The **2010 FEIS project need** expressed the following needs regarding system linkage and route importance.

"WIS 23 is part of the National Highway System (NHS) as designated under the 1998 Transportation Equity Act for the 21st Century (TEA21). NHS routes serve major population centers, intermodal transportation facilities, and major travel destinations and provide connections to the national defense highway network. WIS 23 provides an NHS east-west link between Milwaukee (to the south) and Appleton (to the north).

WIS 23 is a state-designated long truck route. This designation further demonstrates its importance to commercial and economic development interests within the state. Trucks account for approximately 14 percent of the average daily traffic (ADT) using the highway.

WIS 23 is identified in the Corridors 2020/Connections 2030 State Highway Plan as a Connector route. Connector routes are two- and four-lane highways that connect key communities and regional economic centers to the Corridor 2020/Connections 2030 Backbone routes. Backbone routes are a network of key multilane routes that connect major population and economic centers and provide economic links to national and international markets. While making up just 3 percent of the state highway transportation system, these routes carry 37 percent of all auto travel and 53 percent of all truck travel within the state.

As a Connector route within this network, WIS 23 is a major link between Sheboygan and Fond du Lac and connects the Backbone routes of I-43 and US 41. When combined, these highways connect Sheboygan and Fond du Lac to other population, manufacturing, and trade centers, such as Green Bay, Oshkosh, Madison, Milwaukee, and Chicago."

Note that while the FEIS references Corridors 2020, Wisconsin's new Highway Plan is called Corridors 2030. A Summary Plan is available at: <http://www.dot.wi.gov/projects/state/docs/2030-fact-corridors.pdf>. Connections 2030 is WisDOT's Long Range Transportation Plan. Additional information is available at: <http://www.dot.wisconsin.gov/projects/state/connections2030.htm>. Also note that while the FEIS states that truck traffic accounts for 14 percent of the ADT using the highway, traffic forecasts performed in March 2012 indicate that the truck percentage on WIS 23 is now 11.2 percent.

National Highway System

WIS 23 is designated as part of the National Highway System (NHS), and because of its importance in the NHS it is designated as a Connector in the Corridors 2030 state highway plan. Both designations recognize WIS 23 as being integral to safe and efficient regional and statewide travel, thus serving a key role in promoting economic development. Corridors 2030 Connectors design standards meet and exceed NHS design standards. WIS 23 is a critical route connecting metropolitan areas in the state, such as Milwaukee and Appleton.

The importance of the NHS designation, large truck travel, and associated expectations of efficient travel influence various design elements. Design elements considered for this WIS 23 corridor include passing opportunities, intersection layout, turning movements, and specific geometric design standards. These

considerations are based primarily on policies, standards, and specifications adopted by the American Association of State Highway and Transportation Officials (AASHTO). Safety is a prime consideration in the design of all highways.

Corridors 2030 Connector Route

WIS 23 is a Connector Route in the Corridors 2030 and Connections 2030 plans. One of the main design requirements of a Corridors 2030 route has to do with traffic operations. The FDM is WisDOT's highway design manual. FDM 11-5-3, Table 3.1⁶, provides the operational goals for Corridors 2030 (formerly Corridors 2020) routes. They are defined by Level of Service (LOS).⁷ LOS C indicates the LOS on this route must be kept above the operational threshold between LOS C and LOS D (the numeric LOS ≤ 4.0).

FDM 11-5-3.2 states "The highest LOS thresholds are applied to the Corridors 2020 system in recognition of its importance from a mobility and economic development perspective. On Corridors 2020 routes, "minimal to moderate" congestion is allowed. Some "severe" congestion is allowed on non-Corridors 2020 routes in highly urbanized areas." WIS 23 is a Connector Route in the Corridors 2030 plan.

FDM 11-15 Attachment 1.1⁸ shows the cross section components of a rural highway. The Design Annual Average Daily Traffic (AADT) is the projected traffic volume forecast for the design year of the roadway, typically the construction year plus 20 years.⁹

WIS 23 current and projected 2035 AADT volumes fall within the category of Design Classes A2—a 2-lane roadway, and A3—a 4-lane roadway. Design class A2 has a 60 mph design speed whereas design class A3 has a 70 mph design speed.

State Designated Long Truck Route¹⁰

WIS 23 is designated as a primary Oversize Overweight (OSOW) route in the August 2011 state OSOW Freight Network. This designation means very large truck loads, such as those carrying windmill turbines, are directed to use primary routes such as WIS 23. Because WIS 23 is designated as a long truck route and is in the OSOW Freight Network, the roadway and intersections must accommodate truck movements.

The long truck route designation does not add additional design requirements to the WIS 23 roadway. The designation as a long truck route does direct trucks through the WIS 23 corridor, and roadway/intersection design should consider trucks to the extent possible. With any WisDOT improvement, trucks are considered in the geometric design of intersections and medians. However, not all WisDOT projects, because of scope and other factors, are able to address the effect trucks have on traffic operations. Slower moving vehicles, such as trucks, farm equipment, and recreational vehicles create platoons of traffic on 2-lane roadways such as WIS 23. Nontruck traffic is unable to travel the free-flow speed because of the impediment slow-moving vehicles create. This operational problem is exacerbated when passing opportunities are few and opposing traffic volumes are high. While not a requirement of being a long truck route, it is desirable to reduce the negative effects truck traffic has on corridor traffic operations in order to meet driver expectations for this type of facility.

⁶ Facilities Development Manual, 11-5-3 (WisDOT, March 27, 2008; <http://roadwaystandards.dot.wi.gov/standards/fdm/11-05.pdf#fd11-5>)

⁷ LOS describes the operation, or congestion levels, of a roadway. It ranges from LOS A (good) to LOS F (very poor). The Highway Capacity Manual (Transportation Research Board, 5th Edition, 2010) provides more detail on this rating system. It is also discussed to greater extent in criterion 4 of the Purpose and Need evaluation.

⁸ Facilities Development Manual 11-15, Attachment 1.1 (WisDOT, March 27, 2008, <http://roadwaystandards.dot.wi.gov/standards/fdm/11-15-001att.pdf#fd11-15a1.1>)

⁹ Facilities Development Manual (FDM) 11-10-1.1 (WisDOT, December 30, 2002, <http://roadwaystandards.dot.wi.gov/standards/fdm/11-10.pdf>)

¹⁰ Wisconsin State Statute 348.07(4) discusses long truck routes and their designation. State Administrative Rule Trans 276 further expounds on this designation.

Traffic Volume		Roadway Width Dimensions			
Design Class	Design AADT	Design Speed (mph)	Traveled Way Width (feet)	Shoulder Width (feet)	Roadway Width (feet)
A1	Under 3500	60	24	6	36
A2 ¹ (2 lanes)	3,500–8,700 ^A 3,500–15,000 ^C	60	24	10 (8)	44 (40)
A3 ¹ (4 lane divided)	8,700 ^A - 44,000 ^A 8,700 ^B - 53,500 ^B 15,000 ^C - 60,000 ^C	70 ⁴	2 @ 24	6LT (4) 10RT⁵	2 @ 40 (38)
A3 ¹ (6 lane divided)	44,000 ^A - 69,000 ^A 53,500 ^B - 85,000 ^B 60,000 ^C - 90,000 ^C	70 ⁴	2 @ 36	10 LT & RT⁵	2 @ 56

^A For non-freeway Corridors 2020 backbone and connector route, LOS threshold is C/D or 4.0.
^B For freeway Corridors 2020 backbone route, LOS threshold is C/D or 4.0.
^C For other principal and minor arterials, LOS threshold is D/E or 5.0.
Desirable values are shown in bold and minimum values are shown in parentheses.

Table 1-1 FDM 11-15 Attachment 1.1

The table gives AADT thresholds for the different design classes, but these thresholds were based on a typical operations analysis and are for guidance purposes. A footnote on Attachment 1.1 states the following:

¹
The top of the traffic volume range for design class A2 is 8,700 AADT for a Corridors 2020 route and 15,000 AADT for a non-corridors 2020 route. These volumes are based on the 2000 Highway Capacity Manual assuming level terrain, 12-foot lanes, ≥ 6-foot shoulders, 80% passing, 10% trucks, K30 design factor, and 60/40 directional split. In cases where a reduced level of service is determined to be acceptable and the use of passing lanes is found to be adequate treatment for the facility, the 8,700 AADT value for C2020 Connector routes may be increased to 12,000 AADT. Design class A3 assumptions: level terrain, 12-foot lanes ≥ 6-foot shoulders, 10% trucks, K30 design factor, 61/39 directional split, 2 access points per mile, except freeway. See FDM 11-5-3 for additional information on level of service thresholds for different facility types and the respective numerical value.

This footnote indicates that the Design Classification is based on LOS, and the thresholds provided for Design Classification are based on a generic highway segment. For WIS 23, the Design Classification, and corresponding number of lanes, is based on what is necessary to maintain LOS C in the design year for WIS 23's specific roadway and traffic volume characteristics that factor into LOS calculations. Discussion in criterion 4 of this technical memo provides greater description of the factors used in determining LOS. Individual roadway characteristics, such as peak-hour volume, directional distribution of traffic, lane and shoulder width, percent passing zone availability, and truck percentage, all contribute to the LOS calculation for the individual roadway. Operations analysis for WIS 23 indicates that it currently (2012) and in 2015 does not meet the LOS C operational goals for a Connector in the Corridors 2030 plan. Table 1-2 summarizes the operational analysis for the corridor for a construction year of 2015 and the design year 2035. More information regarding the operations analysis is discussed under criterion 4.

System Continuity

WIS 23 provides a National Highway link between Milwaukee (to the south) and Appleton (to the north) as well as between Madison (to the southwest) and Sheboygan. Most of the highways connecting these metropolitan areas are 4-lane divided expressways and freeways. On the 32.5-mile section of WIS 23 from US 151 to I-43, 14 miles is a 4-lane divided highway, and the remaining 18 miles between County K in Fond du Lac County and County P in Sheboygan County is a 2-lane highway. It is desirable, though not required by FDM or AASHTO standards, to have a consistent facility type along WIS 23 linking the US 41, US 151 and

I-43 4-lane arterials. In November 2011, WisDOT informed FHWA of interim guidance it was using to determine the purpose and need for capacity expansion (attached as Appendix B). The guidance references LOS analysis and thresholds and also listed other factors that would support capacity expansion and help satisfy the purpose and need. Those factors included the following.

“Small highway segments that provide lane continuity and logical connections to major facilities or areas.”

This interim guidance factor could support the provision of a 4-lane corridor for the full distance between Fond du Lac and Sheboygan.

WIS 23 Mainline Operation Levels			
2-Lane No Build LOS			
		County UU to County G	
		Eastbound	Westbound
LOS 2015		D	D
LOS 2025		D	D
LOS 2035		D	D
Year LOS passes from C to D		2012	2012
First Year C to D both directions		2012	
		County G to County P	
		Eastbound	Westbound
LOS 2015		D	D
LOS 2025		D	D
LOS 2035		D	D
Year LOS passes from C to D		2012	2012
First Year C to D both directions		2012	

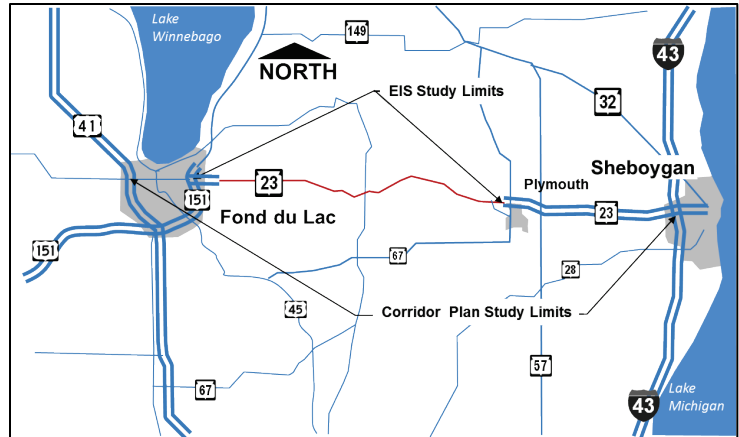


Figure 1-1 WIS 23 System Continuity Between US 41 and I-43

Table 1-2 WIS 23 Operations Analysis

Purpose and Need Screening

All alternatives meet NHS expectations and needs if they are designed to meet Corridors 2030 Connector design criteria. All alternatives will provide a safe and dependable connection between Fond du Lac and Sheboygan. Not all alternatives are able to address the effects of trucks and other slow-moving vehicles on WIS 23 operations.

The following questions are used to determine how well an alternative satisfies the **System Linkage and Route Importance** purpose and need criterion.

a) Does the alternative adequately address truck traffic needs resulting from WIS 23's designation as a long truck route?

To meet this criterion, the alternative must address the operational challenges resulting from trucks and provide geometry that accommodates trucks. Measures such as passing lanes partially address this criterion by providing opportunities for platoons caused by trucks to disperse. A 4-lane expansion would address this criterion by preventing the formation of platoons by allowing through traffic the opportunity to travel around truck traffic. Also, intersection improvements that provide deceleration lanes, left-turn lanes, and adequate turn radii address this criterion by providing intersection geometry that accommodates truck movements.

The No-Build alternative does not meet this purpose and need criterion. No measures are incorporated to address platoons caused by truck traffic and intersection geometry is not improved.

The Passing Lane without Left-Turn Lanes partially meets this criterion. It provides 4 additional passing lanes along the corridor that help disperse platoons caused by truck and heavy vehicle traffic. It does not prevent the formation of platoons.

The Passing Lane with Left-Turn Lanes partially meets this criterion. It provides 4 additional passing lanes along the corridor that help disperse platoons caused by truck and heavy vehicle traffic. It does not prevent the formation of platoons.

The Hybrid 4-Lane to County G, Passing Lane County G to County P partially meets this criterion. From County K to County G, a full 4-lane divided highway is provided that prevents the formation of platoons caused by truck traffic and heavy vehicles. East of County G, it provides two passing lanes for the dispersal of platoons caused by truck traffic.

The 4-Lane Build On-Alignment meets this criterion. It provides a full 4-lane facility for the full length of the corridor that prevents the formation of platoons caused by truck traffic.

b) Does the alternative provide system continuity?

As mentioned it is desirable, though not required, to have a consistent facility type on WIS 23 between the US 151 4-lane expressway and the I-43 4-lane Interstate. To satisfy this criterion, the alternative should provide a reasonable level of consistency. Because this WIS 23 corridor is a 4-lane divided expressway at both ends of the corridor, alternatives that provide a full 4-lane facility satisfy this desire. Alternatives that provide a facility that is less than 4 lanes are considered to partially meet this criterion if there is a significant drop in traffic volume where the 2- or 3-lane facility begins.

The No-Build alternative does not satisfy this criterion because it does not provide a consistent facility type throughout the WIS 23 corridor.

The Passing Lane Without Left-Turn Lanes alternative does not satisfy this criterion. It does not provide a consistent facility type throughout the corridor. The reduction to a 2-lane facility occurs in a portion of the corridor that has only a modest traffic volume reduction.

The Passing Lane With Left-Turn Lanes alternative does not satisfy this criterion. It does not provide a consistent facility type throughout the corridor. The reduction to a 2-lane facility occurs in a portion of the corridor that has only a modest traffic volume reduction.

The Hybrid 4-Lane to County G, Passing Lane County G to County P does not meet this criterion. It does not provide a consistent facility type throughout the corridor and provides an even shorter span of 2-lane highway on the corridor from US 151 to I-43. The reduction to a 2-lane facility occurs in a portion of the corridor that has only a modest traffic volume reduction.

The 4-Lane Build On-Alignment meets this criterion because it provides a full 4-lane facility from US 151 to I-43.

2. Transportation Demand/Regional Economic Development

The **2010 FEIS project purpose** objectives for the proposed action pertaining to purpose and need criterion 2 include the following:

- *Improve the operational efficiency of the WIS 23 corridor, appropriate for the highway's function as a Connector route in the Corridors 2020/Connections 2030 State Highway Plan, promoting regional and statewide economic development.*

The **2010 FEIS project need** expressed the following needs regarding transportation demand and regional economic development.

"WIS 23 provides a connection to many economic sectors within the eastern Wisconsin region, such as manufacturing, tourism, recreation, agriculture, and trade. As a two lane highway facility, WIS 23 will not meet the operational and safety needs to serve these economic sectors as traffic increases.

Increasing travel time and traffic hazards contribute to higher transportation costs for commuters and truck traffic. Increased travel and shipping costs result in higher product costs. This makes existing local businesses less competitive and less likely to expand and makes it more difficult for communities in the region to attract new business and industry. The consumer may also see higher product prices. Increased travel times may prevent extension of local business customer service and supply areas.

Highway improvements that lower transportation costs and increase accessibility create a positive perception of the region, increase its competitiveness, and enhance economic development opportunities. Certain industries may be attracted to corridor communities because of improved access to population centers, suppliers, or buyers. Conversely, failing to improve the existing deficient access conditions may prevent new business and employment opportunities.

Improved travel routes to recreational facilities benefit tourism in east central Wisconsin recreational areas through reduced travel time, increased safety, and more relaxed and predictable travel. Recreational destinations such as Elkhart Lake, the golf courses of Kohler, and state parks and forests have been successful in drawing local, state, national, and international visitors. Future international events at these venues will draw even more travelers that will use WIS 23."

The WIS 23 corridor was incorporated as a Connector into the Corridors 2030 state highway plan because of its multifaceted role. WIS 23 connects producers with markets, people to jobs, and is an important link to recreational facilities in east central Wisconsin. Economics is a key factor in the designation of both Backbone and Connector Routes in Corridors 2030. Reducing travel times and providing predictable travel times decrease transportation costs for businesses and increase the attractiveness of the corridor and adjacent communities for business development. Providing easy and intuitive access also helps businesses that rely on tourists and recreational patrons.

Reducing traffic hazards decreases industry costs on vehicles, lost shipments, travel time, and employee value. Because traffic hazards are directly related to safety, this purpose and need component is discussed under criterion 7, Safety.

Travel Time and Predictability

Providing a satisfactory LOS affects travel time and travel time predictability. FDM 11-5-3.2 states "The highest LOS thresholds are applied to the Corridors 2020 system in recognition of its importance from a mobility and economic development perspective. On Corridors 2020 routes, "minimal to moderate"

congestion is allowed.”¹¹ WIS 23 is a Connector Route in the Corridors 2030 plan. On 2-lane roadways such as WIS 23, platoons of vehicles prevent travelers from moving the free-flow speed and increase the percent time spent following another vehicle. Operational analyses show that in 2015 the average traveling speed on WIS 23 is 46 to 47 mph during peak hours, even with a posted speed limit of 55 mph.

Reducing travel time is a function of the highway facility's free-flow speed and providing satisfactory LOS. According to FDM 11-15 Attachment 1.1,¹² 4-lane expressways have a design speed of 70 mph and a posted speed of 65 mph.¹³ Sixty-five mph is the posted speed of the 4-lane WIS 23 roadway east of this study corridor. Two-lane state trunk highways have a design speed of 60 mph and a posted speed of 55 mph. Fifty-five mph is the posted speed on WIS 23 within the study corridor. The difference in just the free-flow speeds amounts to about 3 minutes in travel time per corridor trip, which equates to over 150,000 travel hours per year.

Passing lanes help relieve platooning on 2-lane roadways, but they typically are not able to remove all platooning. Operational analyses on WIS 23 indicate passing lanes improve travel speeds by about 1 to 2 mph in the 2015 peak hour. This amounts to a 10- to 20-second travel time reduction for the 2-lane portion of the corridor over the No-Build alternative in the 2015 peak hour.

Four-lane roadways that operate above LOS C allow most vehicles to travel the free-flow speed of the roadway. The additional lane provides opportunity for vehicles to travel around slower vehicles. Operational analyses on WIS 23 indicate a 4-lane facility would provide 65 mph travel speeds on WIS 23 during the 2015 peak hour. The travel time difference between the No-Build 2-lane facility and 4-lane Build On-Alignment for the 18-mile 2-lane portion of the corridor would be almost 6 minutes 20 seconds during the 2015 peak hour. WIS 23 operational analysis is discussed in greater detail under criterion 4, Existing and Future Traffic Volumes and Resulting Operations.

Travel time predictability, or reliability, is a function of the LOS and other events that can affect travel time for a smaller portion of traffic. Examples could include crashes that block through streams of traffic or other traffic flow disruptions that can randomly and significantly affect travel time. Travel time predictability is growing as a service measure in urbanized environments where travel times can vary widely because of unstable traffic flow, incidents, and other disruptions. In 2010 FHWA highlighted reliability in its *Urban Congestion Trends* series titled *Enhancing System Reliability with Operations*. For WIS 23, travel time predictability, or reliability, is a function of the LOS as well as through traffic interaction with slower vehicles. Agricultural machinery uses WIS 23 and can encroach upon the travel lanes. This combined with the difficulty in passing because of opposing traffic can substantially decrease travel speeds. Providing reliable and predictable travel on WIS 23 aids the flow of goods and people through the corridor and between metropolitan areas and helps in promoting regional and statewide economic development.

Purpose and Need Screening

All build alternatives improve WIS 23. Reduced travel times and traffic hazards can lower transportation costs and create a positive perception of the region, enhance its competitiveness for attracting and retaining business, and enhance economic development opportunities. Predictable travel time can also benefit WIS 23 as a recreation route and benefit area tourism.

The following questions are used to determine how well an alternative satisfies the **Transportation Demand and Regional Economic Development** purpose and need criterion.

a) Does the alternative reduce travel time?

This criterion is accomplished by providing effective passing opportunities and allowing vehicles to travel at the free-flow speed of the highway, both of which contribute to providing a satisfactory LOS.

¹¹ Facilities Development Manual 11-5-3.2 (WisDOT, March 27, 2008; <http://roadwaystandards.dot.wi.gov/standards/fdm/11-05.pdf>)

¹² Facilities Development Manual 11-15 Attachment 1.1 (WisDOT, March 27, 2008; <http://roadwaystandards.dot.wi.gov/standards/fdm/11-05.pdf>)

¹³ Typically the posted speed is 5 mph below the design speed.

The No-Build alternative does not satisfy this criterion. Average travel speeds during peak hours in 2015 remain at 46 mph.

The Passing Lane Without Left-Turn Lanes alternative does not satisfy this criterion. While providing opportunities to pass and relieve platoons, the passing lanes only increase the average travel speed during peak periods in 2015 by 1 to 2 mph, to almost 48 mph, which reduces the travel time through the 2-lane portion of the corridor by a little more than 20 seconds when compared to the No-Build alternative.

The Passing Lane With Left-Turn Lanes alternative does not satisfy this criterion. While providing opportunities to pass and relieve platoons, the passing lanes only increase the average travel speed during peak periods in 2015 by almost 1 mph, to 47 mph, which reduces the travel time through the 2-lane portion of the corridor by about 10 seconds when compared to the No-Build alternative.

The Hybrid 4-Lane to County G, Passing Lane County G to County P partially meets this criterion because for half the corridor it provides a facility with higher travel speeds and prevents the formation of platoons. The other half of the corridor from County G east will continue to have travel speeds around 48 mph during peak periods. This alternative reduces travel time through the 2-lane portion of the corridor in 2015 peak periods by about 3 minutes and 40 seconds when compared to the No-Build alternative.

The 4-Lane Build On-Alignment fully meets this purpose and need criterion because it provides a full 4-lane facility with high free-flow speeds and high LOS. This alternative reduces travel time through the 2-lane portion of the corridor in 2015 peak periods by about 6 minutes and 20 seconds when compared to the No-Build alternative.

b) Does the alternative provide for more predictable travel?

This criterion is satisfied by maintaining satisfactory LOS consistently throughout the corridor and reducing the negative effect of slow-moving agricultural, truck, and recreational vehicle traffic on the WIS 23 through travel stream. WIS 23's current lack of passing opportunities and available gaps in the opposing travel stream make passing slow-moving vehicles difficult. Reducing the negative effect of slow-moving traffic can be accomplished by providing opportunities to pass through passing lanes or capacity expansion.

Crashes also affect travel predictability. Because traffic hazards are directly related to roadway safety, this purpose and need component is discussed under criterion 7, Safety.

The No-Build alternative does not satisfy this criterion because the negative effect of slow-moving agricultural, truck, and recreational vehicles is not mitigated.

The Passing Lane Without Left-Turn Lanes alternative does not satisfy this criterion. For 4 lane miles of the 36 lane miles (2 directions x 18 miles) of the 2-lane corridor, there are opportunities to pass slow-moving agricultural, truck, and recreational vehicles. For the remaining 32 miles, vehicles must look for gaps in the opposing travel stream to travel around slow-moving traffic.

The Passing Lane With Left-Turn Lanes alternative does not satisfy this criterion. For 4 lane miles of the 36 lane miles (2 directions x 18 miles) of the 2-lane corridor, there are opportunities to pass slow-moving agricultural, truck, and recreational vehicles. For the remaining 32 miles, vehicles must look for gaps in the opposing travel stream to travel around slow-moving traffic.

The Hybrid 4-Lane to County G, Passing Lane County G to County P partially satisfies this criterion. For approximately 24 lane miles of the 36 lane-mile corridor (4 lanes for 11 miles, plus 2 miles of passing lanes), there is opportunity to pass slow-moving agricultural, truck, and recreational vehicles. For the remaining 12 lane miles, vehicles must look for gaps in the opposing travel stream to travel around slow-moving traffic.

The 4-Lane Build On-Alignment satisfies this criterion. With the provision of 4 lanes, high speed traffic is able to travel around slow-moving agricultural, truck, and recreational traffic.

3. Legislative and Transportation Planning History

The 2010 FEIS project purpose objectives for the proposed action that pertain to purpose and need criterion 3 include the following:

- *Preserve the corridor for future transportation needs by coordinating local governmental land use plans with transportation improvement plans....Proper planning will help alleviate development pressures on WIS 23 while addressing environmental issues for the future highway project.*
- *Maintain a rural highway-type facility while addressing the increased traffic needs of the expanding urban areas.*

The 2010 FEIS project need expressed the following needs regarding legislative and transportation planning history.

"In March 1989, WisDOT submitted its Corridors 2020 Report to the Governor that described proposed Backbone and Connector components of the state's highway system. The purpose of Corridors 2020 is to create a network of superior quality highways to foster economic development and meet intercity mobility needs into the 21st century. As mentioned in Section 1.3 A., WIS 23 is identified in the Corridors 2020 Plan as a Connector route. WIS 23 is functionally classified as a rural principal arterial. The Corridors 2020 Plan has since been incorporated in the Connections 2030 State Highway Plan.

As a Connector route, WIS 23 should be upgraded to meet current standards for roadway width, level of service (LOS), and alignment. An improved WIS 23 that meets these standards will meet the transportation needs of east central Wisconsin and integrate its economy and communities with the rest of Wisconsin and the nation.

In August 1989, WisDOT adopted a statewide plan for mapping access on the state highway system. The purpose of the access plan is to provide a high LOS for through traffic while providing reasonable access to abutting properties. The plan identifies Corridor 2020 Connector routes, like WIS 23, as highways for which managed access is essential for maintaining high levels of service.

In April 1991, the Mobility 2000 report was developed as a legislative amendment to the 1991 to 1993 transportation budget. The report incorporates the recommendations made in the Corridors 2020 Plan. WIS 23 is identified in the Corridors 2020 Plan as a Connector route. In general, Mobility 2000 goes into more detail than the Corridors 2020 Plan on funding and other strategies for implementing the state's transportation program.

The Wisconsin State Legislature in the 1999 Biennial Budget enumerated WIS 23 as a major project. Authorization for expanding highway capacity along the portion of WIS 23 from WIS 67 to US 41 in Sheboygan and Fond du Lac Counties is found in Wis. Stats 84.013(3)(ra)."

Coordination with Local Land Use and Transportation Plans

Local Government:

WisDOT considers local land use and transportation plans whenever corridor improvements are being considered. WisDOT plans corridors that are compatible with local plans to the extent possible while still fulfilling the highway's role in the state transportation system.

Wisconsin State Statute 84.295 Preservation:

WisDOT uses Wisconsin State Statute 84.295 to alert communities of future transportation improvements along a highway. Wisconsin State Statute 84.295 is a long-term planning tool that allows WisDOT to officially designate and preserve highway corridors as expressways/freeways. One principal benefit of this tool is that it identifies to both property owners and local communities the location and future right of way

needed for expressway/freeway conversion improvements. Identifying right of way and access helps minimize costly relocations and/or disruptions to property owners. With this knowledge local government can acknowledge improvements in the local land use plans and approve development in light of future transportation improvements. Future land uses then would not preclude or be incompatible with expressway/freeway conversion improvements. Without active preservation, local development may occur on lands needed for the long-term highway improvements forcing the evaluation of corridors less suitable for transportation improvements. This could result in greater environmental impacts as “best-fit” alignments are precluded by development. Identifying suitable lands for transportation improvements that minimize environmental impacts, and then preserving these lands, helps ensure future transportation improvements have fewer impacts to the environment. Wisconsin State Statute 84.295 is discussed in more detail under criterion 6, Access.

Metropolitan Planning Organizations:

WisDOT coordinates with local Metropolitan Planning Organizations (MPO) for urban centers with a population over 50,000. They are federally mandated policy-making organizations made up of representatives from local government and transportation authorities.¹⁴ An MPO maintains a fiscally constrained Long-Range Transportation Plan (LRTP) for the urban area that fosters mobility and access for people and goods and efficient transportation system performance.

Portions of the WIS 23 corridor are within two separate MPOs. The west end of the corridor is in the Fond du Lac Metropolitan Planning Organization that includes the city of Fond du Lac, Fond du Lac County, the village of North Fond du Lac, and the towns of Fond du Lac, Byron, Empire, Taycheedah and Friendship. The East Central Wisconsin Regional Planning Commission supports and staffs this MPO. The east end of the corridor is near the Sheboygan Metropolitan Planning Organization that includes the cities of Sheboygan and Sheboygan Falls, the villages of Kohler and Howards Grove, the town of Sheboygan, and portions of the towns of Herman, Lima, Mosel, Sheboygan Falls, and Wilson. The Bay-Lake Regional Planning Commission supports and staffs this MPO. Note that this portion of WIS 23 is outside the metropolitan planning area but is included in its air quality conformity analysis of Sheboygan County.

Wisconsin State Statutes

Wisconsin State Statute 13.489 lays out the procedure for the approval of major projects as well as the authorization of new projects to move through the NEPA process. A major project is defined in Wisconsin State Statute 84.013(1)(a) by the two categories as follows:

84.013(1)(a), (Definition of a Major Project)

Category 1—A project that has a total cost of more than \$30,000,000 and satisfies any of the following:

- (1) Constructing a new highway 2.5 miles or more in length.*
- (2) Reconstructing or reconditioning an existing highway by either:*
 - (a) Relocating 2.5 miles or more of the existing highway, or*
 - (b) Adding one or more lanes 5 miles or more in length to the existing highway.*
- (3) Improving to freeway standards 10 miles or more of an existing divided highway having 2 or more lanes in either direction.*

Category 2—A project that has a total cost of more than \$75,000,000 and is not described in Category 1 above.

¹⁴ The United States Congress passed the Federal-Aid Highway Act of 1962, which required the formation of an MPO for any urbanized area with a population greater than 50,000. Congress created MPOs to ensure that existing and future expenditures of governmental funds for transportation projects and programs are based on a continuing, cooperative, and comprehensive (“3-C”) planning process. Statewide and metropolitan transportation planning processes are governed by federal law (23 U.S.C. §§ 134–135).

The procedure outlined in Wisconsin State Statute 13.489 includes the use of a Transportation Projects Commission, which consists of the governor, 3 citizen members appointed by the governor, and 5 state senators and 5 representatives to the assembly. The statute directs the commission to meet biyearly on even-numbered years to approve the preparation of environmental impact statements or environmental assessments for transportation projects that could potentially become major projects. The statute also directs the commission to meet biyearly, on odd-numbered years, to enumerate funding for projects where a NEPA document has been completed and the project merits construction.

In 1999, the Wisconsin State Legislature enumerated WIS 23 as a major project and authorized WisDOT to begin construction. The authorization is found in Wisconsin State Statute 84.013(3)(ra) and is as follows:

84.013

(3) The department may proceed with construction of the following major highway projects:

(ra) STH 23 between STH 67 and USH 41 in Sheboygan and Fond du Lac counties.

With this authorization, the Wisconsin State Legislature avoided the use of the Transportation Projects Commission Process described in State Statute 13.489 and directly enumerated the WIS 23 project. This action by the legislature illustrates WIS 23's regional and economic importance to the state. To qualify as a major project according to the previously referenced 84.013(1)(a), and comply with this enumeration, WIS 23 must add 5 or more lane miles to the corridor.

This enumeration process does not supersede the NEPA/WEPA process. Through the NEPA/WEPA process, lesser alternatives may be selected. If they are selected, the project would no longer qualify as a major project and would no longer be eligible for funding under this program. However, the relevance of the enumeration of this project as a major project by the State Legislature illustrates the statewide recognition of the importance of the corridor for economic development and regional mobility.

Purpose and Need Screening

Coordination with local governments and MPOs will ensure WIS 23 improvements inclusion in local land use and transportation plans. Official mapping of future interchange and overpass right of way needs will alert communities and property owners to future improvements and access modification.

The following questions are used to determine how well an alternative satisfies the **Legislative and Transportations Planning History** purpose and need criterion.

a) Is the alternative consistent with and/or reflected in local land use and transportation plans?

To be consistent, the alternative should be reflected in or not contradict the local land use and transportation plans. Specific MPO plans referencing WIS 23 include the Fond du Lac Area MPO Long Range Transportation Plan (Exhibit 72, Item 11) and the 2035 Update to the Sheboygan Area Plan (page 6-17).

The No-Build alternative does not satisfy this criterion because it contradicts what is incorporated in the MPO long-range plans.

The Passing Lane Without Left-Turn Lane alternative partially satisfies this criterion. This alternative improves the mobility of WIS 23, yet does not provide the 4-lane expansion mentioned in the MPO plans.

The Passing Lane With Left-Turn Lane alternative partially satisfies this criterion. This alternative improves the mobility of WIS 23, yet does not provide the 4-lane expansion mentioned in the MPO plans.

The Hybrid 4-Lane to County G, Passing Lane County G to County P partially satisfies this criterion. This alternative improves the mobility of WIS 23 and provides the 4-lane expansion discussed in the Fond du Lac Area MPO plan. It does not contain the 4-lane expansion discussed in the 2035 update to the Sheboygan Area Plan.

The 4-Lane Build On-Alignment satisfies this purpose and need criterion. The improvement is consistent with that mentioned in both the Fond du Lac Area MPO and Sheboygan Area MPO plans.

b) Is the alternative consistent with the intent of Wisconsin State Statute 84.013(3)(ra)?

To be fully consistent the alternative must add *“one or more lanes 5 miles or more in length to the existing highway.”*

The No-Build alternative does not satisfy this purpose and need criterion. It does not add any lanes to the WIS 23 corridor nor does it improve the mobility of the corridor.

The Passing Lane Without Left-Turn Lanes alternative, while not adding 5 miles of new roadway, does recognize the importance of WIS 23 and acknowledges the intent of the Legislators who passed this Statute and therefore partially satisfies this criterion.

The Passing Lane With Left-Turn Lanes alternative, while not adding 5 miles of new roadway, does recognize the importance of WIS 23 and acknowledges the intent of the Legislators who passed this Statute and therefore partially satisfies this criterion.

The Hybrid 4-Lane to County G, Passing Lane County G to County P satisfies this criterion because it adds more than 5 lane miles to the WIS 23 corridor.

The 4-lane Build On-Alignment satisfies this criterion because it adds more than 5 lane miles to the WIS 23 corridor.

4. Existing and Future Traffic Volumes and Resulting Operations

The 2010 FEIS had several paragraphs describing existing and projected traffic volumes as well as the resulting traffic operation from those volumes. Since the completion of the 2010 FEIS, a Travel Demand Model was developed for the Northeast Region that expands the ability of WisDOT to model network changes. To ensure that the Limited Scope Supplemental EIS reflected up-to-date traffic data, a revised forecast was performed using current traffic data and new forecasting tools. The model results were used with existing traffic data and linear regression techniques to develop revised 2035 forecasts for the WIS 23 corridor.¹⁵

The revised traffic forecasts from July 2012 are similar yet lower than those used for the 2010 FEIS.¹⁶ This has caused some of the text of the 2010 FEIS Purpose and Need dealing with traffic volumes and operations to be outdated in that it either references traffic forecasts that are no longer current or traffic operations analysis that is no longer relevant in light of the revised traffic forecasts. The underlying purpose and need components that involve traffic volumes and operations generally continue to apply to the project. But as mentioned, alternatives that do not involve traditional capacity expansion and were eliminated from detailed analysis in the 2010 FEIS may now have more opportunity to satisfy the Existing and Future Traffic Volumes and Resulting Operation component of the project purpose and need. Therefore, these lesser alternatives are being evaluated to determine if they could now potentially meet the purpose and need.

To avoid confusion, only relevant portions of the Existing and Future Traffic Volumes and Resulting Operation portion of the Project Purpose and Need in the 2010 FEIS are shown below.

The 2010 FEIS project purpose objectives for the proposed action pertaining to purpose and need criterion 4 include the following.

- *Increase the mobility by adding capacity...*
- *Improve the operational efficiency of the WIS 23 corridor, appropriate for the highway's function as a Connector route in the Corridors 2020/Connections 2030 State Highway Plan, ...*
- *Maintain a rural highway-type facility while addressing the increased traffic needs of the expanding urban areas.*

The 2010 FEIS project need expressed the following needs regarding existing and future traffic volumes and the resulting operation.

1. *Traffic Volumes and Composition*

..... Current volumes from 2003 and 2005 show that WIS 23 is approaching the levels where highway capacity expansion improvements are investigated. As traffic volumes increase to those forecasted for the design year 2035, the volumes will be well within the range where four-lane capacity improvements are investigated and implemented.

Truck volumes on WIS 23 are very high. The average daily truck traffic comprises almost 14 percent of the total traffic volume on WIS 23, which on two-lane roadways is particularly detrimental to roadway operational characteristics because passing requires use of the opposing traffic lane. The high numbers of trucks create "platoons" of traffic where vehicles are not able to travel the free-flow speed and have difficulty passing. The truck traffic imposes a direct limitation on the overall capacity of the existing road with the inability to pass, creating conflicts with slower local traffic, recreational vehicles, vehicles towing

¹⁵ The travel demand model, current traffic data and linear regression techniques were reconciled in accordance with National Cooperative Highway Research Program (NCHRP) Report No. 255 Highway Traffic Data for Urbanized Area Project Planning and Design (1982) <http://teachamerica.com/tih/PDF/nchrp255.pdf>. More discussion is provided in a technical memo prepared by WisDOT Northeast Region in Appendix A of this document.

¹⁶ Since 2009 traffic volumes on highways throughout the state of Wisconsin including WIS 23 have decreased. These lower actual traffic volumes have influenced future traffic forecasts. For WIS 23, the result is traffic forecasts are now slightly lower than those shown in the 2010 FEIS.

trailers, and farm machinery. This mixture of traffic impedes traffic flow creating unsafe situations and lowers the efficiency of the roadway.

Traffic along the existing route is comprised of local and through traffic. Local traffic has origins and/or destinations within the municipalities of Plymouth and Fond du Lac, as well as along the corridor. The through traffic does not have origins or destinations within these municipalities.

In 1997, WisDOT conducted origin/destination (OD) surveys in the Fond du Lac area. Approximately 43 percent of all the vehicles were through trips (beyond the City of Fond du Lac or Plymouth) and 58 percent of the truck traffic comprised of through trips.

2. Operation Levels

. As a Corridors 2020/Connections 2030 Connector route, the numeric LOS threshold for mobility improvements on WIS 23 is 4.0, which is the boundary between LOS C and LOS D. These thresholds are based on a balance of social, environmental, and dollar costs and may not match with every traveler's perception of when congestion warrants roadway improvements.

As a Corridors 2020/Connections 2030 Connector route, portions of WIS 23 do not meet the operational standards for a Connector route. Steadily increasing traffic volumes and numerous access points will decrease the mobility and efficiency of the existing highway so that all of the highway will not meet the operational objectives of a Connector route by the year 2035. The combination of high traffic volumes, truck composition, and numerous access points makes it difficult for the WIS 23 to satisfy the operational objectives of a Connector route as a two-lane roadway. ”

Note that the text above references 14 percent truck traffic, whereas the July 2012 traffic forecasts revise the truck percentage to 11.2 percent.

The requirements associated with a Corridors 2020/2030 Connector Route were described in criterion 1, System Linkage and Route Importance. This criterion provides more detail on the operational analyses and how they apply to potential WIS 23 alternatives.

While this 2010 FEIS excerpt mentions the effect of agricultural traffic on highway operations, this is related more to the availability of lanes to bypass the slow-moving traffic. Therefore the effect of farm machinery on WIS 23 operations and the effect of WIS 23 alternatives on farm machinery are discussed in criterion 2b, Predictable Travel Time of this technical memo.

Current WIS 23 Traffic Projections (July 2012)

The most current July 2012 traffic forecasts provide 2035 traffic volume projections for the following scenarios:

- No-Build
- Passing Lane Without Left Turns
- Passing Lane With Left Turns
- Hybrid Facility-4 Lanes to County G and 2 Lanes with Passing Lanes County G to County P¹⁷
- 4-Lane Build On-Alignment

¹⁷ This alternative was not discussed in the 2010 FEIS but was looked at as part of the Limited Scope Supplemental EIS because the July 2012 traffic forecasts show slightly lower volumes in the design year (2035).

Table 4-1 shows the difference between the 2010 FEIS traffic volume forecasts and the July 2012 traffic forecasts for various segments of WIS 23.

Segment	June 2012 Counts	From 2010 FEIS	From July 2012 Forecasts				
		2035 Volumes (No Longer Valid)	2035 No-Build ¹	2035 Passing Lane Without Left-turns ¹	2035 Passing Lane with Left-turn Lanes and Median Refuge ¹	2035 Hybrid 4-Lane to County G Passing Lane County G to County P ¹	2035 4-Lane Build On Alignment ¹
US 151 – County K	12,200	Not Given	17,400	16,000	16,000	16,300	17,000
County K – County UU	11,100	18,400	12,300	13,100	13,100	13,600	14,200
County UU – Hinn Rd	8,800	12,400-13,700 ²	10,800	11,000	11,000	11,500	11,900
Hinn Rd – County W	8,800	15,800	9,500	11,000	11,000	11,500	11,900
County W – County G	8,100	12,200-13,400 ²	9,100	9,700	9,700	10,400	11,000
County G – County T	7,600	11,200-14,700 ²	8,500	9,100	9,100	9,400	10,200
County T – County A	9,500	Not Shown	8,800	9,300	9,300	9,700	10,500
County A – County P	8,000	14,600	10,400	10,700	10,700	11,200	12,000

Table 4-1 2010 FEIS and July 2012 Traffic Forecasts for Year 2035

Operations Analysis Methods

The operation of a highway facility is typically expressed as Level of Service (LOS) and ranges from LOS A (good) to LOS F (poor), which are defined in the 2010 Highway Capacity Manual (HCM) Chapter 5.¹⁸ There are different defining characteristics for each type of highway facility. For example, the LOS definitions are different for an intersection than they are for a 2-lane highway. The LOS definitions are also different for a 4-lane highway. Similarly, there are different service measures for different types of facilities.

2-Lane Roads

The WIS 23 existing and passing lane operational analysis used the methodology for 2-lane highways as described in Chapter 15 of the 2010 HCM.¹⁹ The LOS is determined by the percent time-spent-following. Chapter 5 of the manual states the following:

“Percent time-spent-following represents the freedom to maneuver and the comfort and convenience of travel. It is the average percentage of travel time that vehicles must travel in platoons behind slower vehicles because of the inability to pass.”

Chapter 15 of the HCM provides three analysis classes for the 2-lane capacity analysis. Class 1 highways are highways where motorists expect to travel at relatively high speeds. Because of WIS 23's classification as a Connector in the Corridors 2030 state highway plan, it is a Class 1 highway. Two-lane highways that are major intercity routes, primary connectors of major traffic generators, daily commuter routes, or major links in state or national highway networks are generally assigned to Class 1. These facilities serve mostly long-distance trips or provide the connections between facilities that serve long-distance trips. As a 2-lane Class 1 highway, WIS 23 must

¹⁸ 2010 Highway Capacity Manual (Transportation Research Board, 5th Edition, 2010)

¹⁹ The 2-lane analysis used in the 2010 FEIS used a microscopic traffic simulation program from the Interactive Highway Safety Design Model (FHWA) because the 2000 HCM did not have a good analysis model for passing lanes. The 2010 Highway Capacity Manual (Transportation Research Board, 5th Edition, 2010) provides a better 2-lane and passing lane analysis tool and therefore is used in this analysis.

maintain an LOS C. LOS C means that the percent time-spent-following is greater than 50 percent and less than 65 percent, according to 2-Lane Roadway LOS²⁰ from 2010 HCM, pages 15-7 and 15-8. LOS C also means that most vehicles are traveling in platoons and speeds are noticeably curtailed.

2-Lane Roads with Passing Lanes

Two-lane roadways with passing lanes are analyzed as 2-lane roadways as described in Chapter 15 of the HCM. The length and location of passing lanes are a required input into the standard analysis and are described on pages 15-28 to 15-33 of the HCM.

4-Lane Roads

The WIS 23 4-Lane Build On-Alignment alternative uses the operations analysis procedures described in Chapters 10-14 of the 2010 HCM, which includes freeways, basic freeway segments, weaving segments, merge and diverge segments, and multilane highways. Figure 4-1 is taken from Figure 3 (a) of HCM Chapter 2 and schematically illustrates the different freeway analysis components. Multilane highways that are not freeways (e.g., they contain intersections) are often called expressways and have similar analysis components. Chapter 14 of the HCM states:

“Uninterrupted flow on multilane highways is in most ways similar to that on basic freeway segments (Chapter 11 HCM). Several factors are different, however. Because side frictions are present in varying degrees from uncontrolled driveways and intersections as well as from opposing flows on undivided cross sections, speeds on multilane highway tend to be lower than those on similar basic freeway segments.”

When expressways use interchanges instead of intersections, the freeway analysis components of the freeway merge segment, diverge segment, and basic segment apply. The LOS density characteristics for multilane highways are the same as those for a Freeway Basic Segment LOS except that free-flow speed factors into the density thresholds for LOS E and F. This is described in more detail in the 2010 HCM page 14-4.

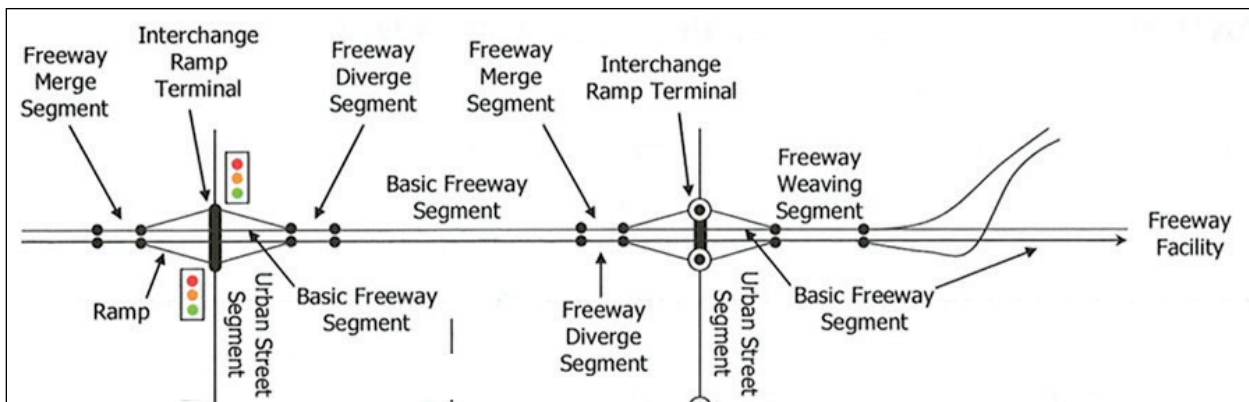


Figure 4-1 Freeway Operational System Elements

For 4-lane roadways, the LOS is determined by the density of traffic per lane per mile. The denser the freeway segment, the more difficult it is to maneuver. Unlike speed, density increases as flow increases up to capacity, resulting in a service measure that is both perceivable by motorists and is sensitive to a broad range of flows. Chapters 11 and 13 of the 2010 HCM describe Freeway Basic Segment LOS²¹ C as providing “for flow with speeds near the free-flow speed of the freeway. Freedom to maneuver within the traffic stream is noticeably restricted, and lane changes require more care and vigilance on the part of the driver.” The Level of Service Characteristic for

²⁰ Physical roadway inputs into the HCM operations analysis include lane widths, shoulder widths, access point density, terrain, percent no-passing zones, speed limit, base design speed, passing lane lengths, and pavement conditions. Traffic inputs include hourly automobile traffic, analysis period, peak-hour factor (determines how much of the peak-hour traffic occurs in the peak 15 minutes), directional split, heavy vehicle percentage, and the presence of occupied parking.

²¹ Roadway inputs into the operations analysis include free-flow speed, number of mainline lanes, lane width, lateral clearance, ramp density, and terrain. Traffic inputs include traffic demand during the analysis period, heavy vehicle presence, peak-hour factor, and driver population factor. These paragraphs only briefly summarize how LOS is calculated on freeway segments.

Freeways²² and for Merging and Diverging Freeway Segments for LOS C are 18²³ to 26 passenger cars/mile/lane and 20²⁴ to 28 passenger cars/mile/lane, respectively. For multilane highways (expressways), the LOS C threshold densities are the same.

Intersections

There are no direct LOS requirements for intersections associated with a Corridors 2030 route. FDM 11-5-3.2 Table 3.1²⁵ lists the acceptable LOS for highways, yet the accompanying text states

Table 3.1 is not intended for use to determine appropriate LOS at controlled intersections. Intersection LOS will be determined on a case-by-case basis dependent on the local land use, economic, social and environmental impacts.

Because WIS 23 is a high mobility corridor and a Corridors 2030 Connector Route, signals are not desired. Signals introduce substantial delay for WIS 23 vehicles, they reduce the mobility of the corridor, and they are contrary to driver expectations on a high speed corridor. Because of this, access to WIS 23 will either be through interchanges (with the previously described merges and diverges) or at two-way stop-controlled intersections where the side-road vehicle is required to stop and wait for a gap in traffic before crossing or entering WIS 23 traffic. The operations analysis for Two-Way Stop-Controlled intersections is described in Chapter 19 of the HCM and uses gap acceptance models. The LOS is calculated by how long a side-road vehicle has to wait before making its maneuver. Table 4-2 summarizes the side-road LOS as defined in Exhibit 19-1 from the HCM.

Control Delay (s/vehicle)	LOS by Volume to Capacity Ratio V/C≤1.0
0-10	A
>10-15	B
>15-25	C
>25-35	D
>35-50	E
>50	F

**Table 4-2 Exhibit 19-1 from HCM
LOS for Two-Way Stop-
Controlled Intersections**

Delay thresholds for Two-Way Stop-Controlled intersections are lower than those for signalized intersections because the uncertainty on the part of side-road users and need for vigilance reduces the travelers' delay tolerance.

While not required to establish an LOS threshold for side-road intersections on WIS 23, WisDOT seeks to provide reasonable operation levels at all intersections and WisDOT defines this as LOS D.²⁶ Operation levels tend to deteriorate at more highly used intersections because there is a higher demand for access which leads to queuing. Higher volume intersections along WIS 23 include county trunk highways that are classified either as minor arterials or rural collectors. This becomes more critical and more difficult to achieve at the highly used intersections of County G, County UU, and County W. Table 4-2 provides the side-road LOS for two-way stop-controlled intersections on major intersections along the corridor.

²² The LOS density characteristics for multilane highways that are not freeways (e.g., they contain intersections) are the same as those for a Freeway Basic Segment LOS except that free-flow speed factors into the density thresholds for LOS E and F. This is described in more detail in the 2010 Highway Capacity Manual page 14-4 (Transportation Research Board, 5th Edition, 2010).

²³ The range spans from *just greater than* 18 pc/m/l to 26 pc/m/l.

²⁴ The range spans from *just greater than* 20 pc/m/l to 28 pc/m/l.

²⁵ Facilities Development Manual 11-5-3, (WisDOT; March 27, 2008; <http://roadwaystandards.dot.wi.gov/standards/fdm/11-05.pdf#d11-5>)

²⁶ Most municipalities, county, and state governments establish LOS D as an acceptable intersection operation level. As such, this LOS would be expected at higher use intersections along WIS 23 to ensure effective access.

Intersection	Forecast Year	No Build Side Street LOS							
		NBL/TH		NBR		SBL/TH		SBR	
		Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
County G	2015	32.2	D	11.8	B	29.6	D	10.1	B
	2025	50.2	F	12.6	B	42.8	E	10.4	B
	2035	77.7	F	13.4	B	68.4	F	10.7	B
County UU	2015	24.7	C	11.0	B	21.4	C	11.5	B
	2025	31.3	D	11.4	B	25.1	D	12.1	B
	2035	42.8	E	11.9	B	30.7	D	12.8	B
County W/Loehr	2015	46.2	E	12.5	B	82.9	F	11.1	B
	2025	54.0	F	12.7	B	112.3	F	11.2	B
	2035	67.2	F	12.9	B	211.9	F	11.3	B
General Intersection (2035 Mainline Traffic approx 10,000 ADT)	20 Turns Out	27.8	D	27.8	D	26.8	D	26.8	D
	40 Turns Out	32.2	D	32.2	D	31.1	D	31.1	D
	60 Turns Out	39.8	E	39.8	E	38.2	E	38.2	E
	80 Turns Out	52.8	F	52.8	F	50.4	F	50.4	F
	100 Turns Out	79.6	F	79.6	F	76.9	F	76.9	F
NBL = Northbound Left NBR = Northbound Right SBL = Southbound Left SBR = Southbound Right TH = Through									

Table 4-3 WIS 23 Intersection LOS

Table 4-3 illustrates the left-turn and through movements at major intersections are, or soon will be, experiencing substantial delays.

Facility changes on WIS 23 will change the way some at-grade intersections are analyzed between the alternatives. For example, a left-turn maneuver onto an undivided highway must identify gaps in both eastbound and westbound traffic. If a median refuge is provided with sufficient storage for one vehicle, the left-turn movement can be made in two movements. The vehicle first identifies a gap in one traffic direction, crosses to the median, and then waits for an acceptable gap in the opposing travel direction. This operational change to side-road operations would be implemented for any alternative that introduces a median onto WIS 23. Similarly, side-road intersection operations change when an intersection is converted to an interchange. The left turn from a side-road LOS is calculated in seconds of control delay. If the intersection is converted to an interchange, the LOS is calculated by the control delay at the ramp terminal and the density at the merge segment of the freeway. For WIS 23 projected volumes, the ramp terminal LOS and merging densities would operate at LOS A whereas a two-way-stop-controlled intersection would operate very poorly. Similarly, the installation of a J-turn at an intersection changes the left-turn delay to the combined delay of a right-turn movement and the delay associated with a U-turn from the mainline. (Note: The installation of J-turns is not possible on the 2-lane Passing Lane alternatives because it requires a large divided median to allow trucks to make a U-turn. Providing such a large median would eliminate passing opportunities for much of the corridor.) Figure 4-2 illustrates these transitions and how the operation of the movements changes.

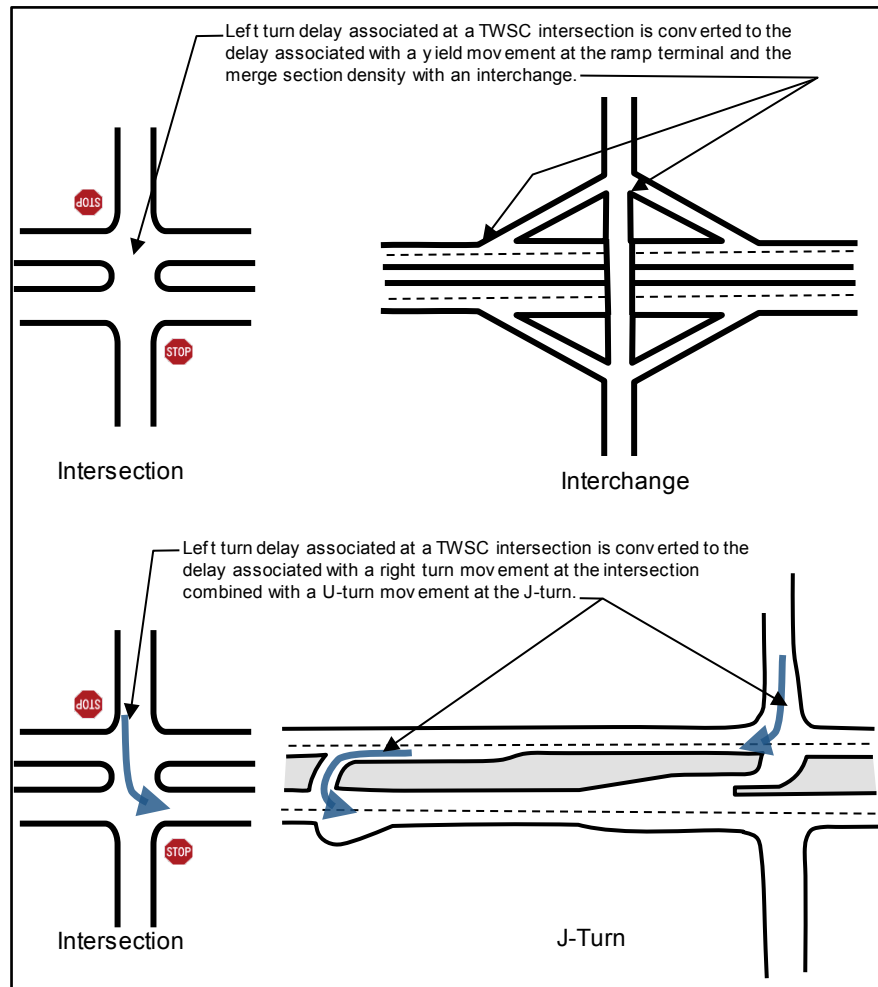


Figure 4-2 LOS Transition from Intersection to Interchange and J-Turn

WIS 23 Mobility

As mentioned, one factor that plays heavily into mainline operations is the absence of traffic control that would stop or delay WIS 23 traffic. High mobility highways, such as Corridors 2030 routes, place a premium on maintaining through traffic movement. Yet in urban areas, side-road access demand often leads to local requests for traffic signals. Increasing traffic volumes on the mainline make it more difficult to enter and cross it from a side road. These delays can increase crash frequencies. Yet traffic signals would increase WIS 23 delay and introduce crashes associated with signals. Signals do not meet expectations on a rural highway. Multiple signals on urbanizing corridors substantially reduce mobility and are contrary to the objectives of a Corridors 2030 Route. For this reason, maintaining a rural highway-type facility while addressing increased traffic needs is a component of the project purpose and need. Outside the Fond du Lac urban area, WisDOT seeks to prevent the degradation of mobility on WIS 23 by avoiding signal installation but still provide reasonable access to and across WIS 23.²⁷

Purpose and Need Screening

All alternatives will maintain a rural highway-type facility outside the Fond du Lac urban area. All build alternatives will improve operational efficiency over the baseline existing two-lane facility operation but to varying degrees.

²⁷ Note: Inside Fond du Lac, a roundabout will be installed at Wisconsin American Drive to slow traffic prior to entering the signalized US 151 interchange and to provide access out of the Wisconsin American Business Park.

The following question indicates how well an alternative satisfies the **Existing and Future Traffic Volumes and Resulting Operations** project purpose and need criteria.

a) Does the alternative improve WIS 23 mainline operational efficiency and mobility by meeting LOS requirements of a Corridors 2030 Connector Route? (LOS C or below numeric LOS 4.0)

WIS 23 Mainline Alternative Comparison

The operational goals for a Corridors 2030 route, such as WIS 23, are to maintain an LOS C in the 2035 design year. Table 4-4 summarizes the mainline operations for the alternatives being considered. The analyses was broken into two sections, from County UU to County G and from County G to County P, to more accurately account for the traffic variations along the corridor in the analysis. Breaking the analysis into sections also allows each section to be evaluated individually to see if lower build alternatives have the potential to meet the operational component of the project purpose and need.

	CTY UU to CTY G									
	2-Lane No Build		Passing Lane Alternatives						4-Lane Build On-Alignment	
			Passing Lanes Without Left Turn Lanes		Passing Lanes With Left Turn Lanes		Hybrid 4-Lane to CTY G, Passing Lane CTY G to CTY P			
	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound*	Westbound*	Eastbound*	Westbound*
% Following 2015	76.4%	76.6%	64.1%	63.7%	65.4%	65.1%	---	---	---	---
LOS 2015 (Numeric)	4.76	4.77	3.94	3.91	4.03	4.01	---	---	---	---
LOS 2015	D	D	C	C	D	D	A	A	A	A
% Following 2025	78.2%	78.4%	67.4%	67.1%	68.7%	68.3%	---	---	---	---
LOS 2025 (Numeric)	4.88	4.89	4.16	4.14	4.25	4.22	---	---	---	---
LOS 2025	D	D	D	D	D	D	A	A	A	A
% Following 2035	78.4%	78.6%	68.8%	68.3%	69.9%	69.5%	---	---	---	---
LOS 2035 (Numeric)	4.89	4.91	4.25	4.22	4.33	4.30	---	---	---	---
LOS 2035	D	D	D	D	D	D	A	A	A	A
Year LOS passes from C to D	2012	2012	2017	2018	2013	2013	---	---	---	---
First Year C to D both directions	2012		2017		2013		---		---	
							*4-Lane Freeway Analysis			

	CTY G to CTY P									
	2-Lane No Build		Passing Lane Alternatives						4-Lane Build On-Alignment	
			Passing Lanes Without Left Turn Lanes		Passing Lanes With Left Turn Lanes		Hybrid 4-Lane to CTY G, Passing Lane CTY G to CTY P			
	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound*	Westbound*
% Following 2015	73.1%	73.8%	64.7%	64.1%	67.1%	66.9%	64.8%	64.0%	---	---
LOS 2015 (Numeric)	4.54	4.59	3.98	3.94	4.14	4.13	3.99	3.93	---	---
LOS 2015	D	D	C	C	D	D	C	C	A	A
% Following 2025	74.2%	74.9%	67.0%	66.3%	69.4%	69.0%	68.1%	67.3%	---	---
LOS 2025 (Numeric)	4.61	4.66	4.13	4.09	4.29	4.27	4.21	4.15	---	---
LOS 2025	D	D	D	D	D	D	D	D	A	A
% Following 2035	76.4%	77.1%	69.0%	68.5%	71.2%	71.1%	69.7%	69.2%	---	---
LOS 2035 (Numeric)	4.76	4.81	4.27	4.23	4.41	4.41	4.31	4.28	---	---
LOS 2035	D	D	D	D	D	D	D	D	A	A
Year LOS passes from C to D	2012	2012	2017	2017	2012	2012	2016	2016	---	---
First Year C to D both directions	2012		2017		2012		2016		---	

Table 4-4 WIS 23 Mainline LOS by Alternative

The No-Build alternative does not satisfy the operational component of the purpose and need. Mainline WIS 23 operates at LOS D in all directions through the year 2035.

The Passing Lane Without Left-Turn Lanes does not satisfy the operational component of the project purpose and need. WIS 23 operates at LOS D (or above the numeric LOS of 4.0) in both directions by 2025 and continues at this LOS through the 2035 design year.

The Passing Lane With Left-Turn Lanes does not satisfy the operational component of the project purpose and need. The eastbound direction on both the west and east sections operates at LOS D (or above the numeric LOS of 4.0) by 2015 and continues at this LOS through the 2035 design year. The Passing Lane With Left-Turn Lanes operates poorer than the same alternative without left-turn lanes because the installation of the left-turn lanes reduces the percent passing availability by 16 percent, decreasing the LOS of the alternative.

The Hybrid 4-Lane to County G, Passing Lane County G to County P alternative was developed during the formation of alternatives for the Limited Scope SEIS to see if it had the potential to satisfy the project purpose and need with the revised and lower traffic volume forecasts. It incorporates a 4-lane facility on the west portion of the corridor and a 2-lane highway, with passing lanes, on the east portion of the corridor. Even with lower traffic forecasts, this alternative does not satisfy the project purpose and need for this criterion. The 4-lane section from County UU to County G operates at LOS A in 2035. The increased traffic volumes associated with this alternative cause the east end of the corridor (the end with passing lanes) to fall to LOS D (or above the numeric LOS of 4.0) by 2025 and continue at this LOS through the 2035 design year. The passing lane portion of this alternative (east section) performs worse than the east section of the regular passing lane alternative because the 4-lane expansion portion of the alternative causes higher forecast traffic volumes, which in turn decrease the LOS on the east end of the corridor.

The 4-Lane Build On-Alignment alternative satisfies the project purpose and need. WIS 23 will operate at LOS A in both directions in the 2035 design year.

b) Does the alternative provide a reasonable LOS for vehicles trying to access WIS 23?

Intersection Side-Road Alternative Comparison

Table 4-5 summarizes the side-road operation levels associated with each of the build alternatives, and Table 4-3 summarizes the operations for the No-Build alternative.

Intersection	Forecast Year	Side Road LOS - Passing Lane <u>Without</u> Left Turn Lanes								Side Road LOS - Passing Lane <u>With</u> Left Turn Lanes							
		NBL/TH		NBR		SBL/TH		SBR		NBL/TH		NBR		SBL/TH		SBR	
		Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
County G	2015	33.1	D	11.8	B	30.7	D	10.1	B	20.3	C	11.8	B	20.3	C	10.1	B
	2025	59.5	F	12.8	B	48.2	E	10.5	B	26.0	D	12.8	B	26.0	D	10.5	B
	2035	128.3	F	14.1	B	100.9	F	10.9	B	33.3	D	14.1	B	35.7	E	10.9	B
County UU	2015	24.9	C	11.0	B	21.7	C	11.5	B	16.2	C	11.0	B	15.7	C	11.5	B
	2025	34.0	D	11.6	B	26.8	D	12.3	B	19.5	C	11.6	B	17.5	C	12.3	B
	2035	54.0	F	12.3	B	35.2	E	13.3	B	23.3	C	12.3	B	19.8	C	13.3	B
County W/Loehr	2015	49.2	E	12.7	B	93.6	F	11.2	B	23.5	C	12.7	B	31.2	D	11.2	B
	2025	82.9	F	13.4	B	328.5	F	11.6	B	28.5	D	13.4	B	46.3	E	11.6	B
	2035	236.3	F	14.3	B	>600	F	12.1	B	37.3	E	14.3	B	101.8	F	12.1	B
General Intersection (2035 Mainline Traffic approx 10,000 ADT)	20 Turns Out	27.8	D	27.8	D	26.8	D	26.8	D	17.9	C	17.9	C	17.1	C	17.1	C
	40 Turns Out	32.2	D	32.2	D	31.1	D	31.1	D	19.2	C	19.2	C	18.4	C	18.4	C
	60 Turns Out	39.8	E	39.8	E	38.2	E	38.2	E	20.8	C	20.8	C	20.3	C	20.3	C
	80 Turns Out	52.8	F	52.8	F	50.4	F	50.4	F	23.1	C	23.1	C	23.0	C	23.0	C
	100 Turns Out	79.6	F	79.6	F	76.9	F	76.9	F	26.2	D	26.2	D	26.9	D	26.9	D
		NBL = Northbound Left NBR = Northbound Right SBL = Southbound Left SBR = Southbound Right TH = Through															
Intersection	Forecast Year	Side Road LOS - Hybrid 4-Lane to Cty G, Passing Lane Cty G to Cty P								Side Road LOS - 4-Lane Build On-Alignment							
		NBL/TH		NBR		SBL/TH		SBR		NBL/TH		NBR		SBL/TH		SBR	
		Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
County G	2015	Interchange ramp terminals: LOS A-LOS B								Interchange ramp terminals: LOS A-LOS B							
	2025	Interchange merge and diverge: LOS A								Interchange merge and diverge: LOS A							
	2035																
County UU	2015	Interchange ramp terminals: LOS A								Interchange ramp terminals: LOS A							
	2025	Interchange merge and diverge: LOS A								Interchange merge and diverge: LOS A							
	2035																
County W/Loehr J-Turn	Forecast Year	J-Turn Middle Intersection				West Intersection		East Intersection		Middle Intersection				West Intersection		East Intersection	
		NBR		SBR		WBU		EBU		NBR		SBR		WBU		EBU	
		Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
	2015	10.9	B	10.6	B	12.0	B	10.3	B	10.9	B	10.7	B	12.1	B	10.3	B
	2025	11.5	B	11.2	B	12.9	B	10.6	B	11.6	B	11.2	B	13.1	B	10.6	B
Intersection	2035 Side-street turns	NBL/TH		NBR		SBL/TH		SBR		NBL/TH		NBR		SBL/TH		SBR	
		Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
		Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
General Intersection (2035 Mainline Traffic approx 10,000 ADT)	20 Turns Out	17.9	C	17.9	C	17.1	C	17.1	C	15.8	C	15.8	C	14.6	B	14.6	B
	40 Turns Out	19.2	C	19.2	C	18.4	C	18.4	C	16.3	C	16.3	C	14.9	B	14.9	B
	60 Turns Out	20.8	C	20.8	C	20.3	C	20.3	C	17.2	C	17.2	C	15.6	C	15.6	C
	80 Turns Out	23.1	C	23.1	C	23.0	C	23.0	C	18.4	C	18.4	C	16.5	C	16.5	C
	100 Turns Out	26.2	D	26.2	D	26.9	D	26.9	D	20.0	C	20.0	C	17.8	C	17.8	C

Table 4-5 Side-Road Operations by Build Alternative²⁸

²⁸ Note: J-turns cannot be installed on the 2-lane passing lane alternatives because a wide median is required to allow trucks to make a U-turn.

Table 4-3 shows that the No-Build alternative does not satisfy this purpose and need criterion. WIS 23 operates at LOS D in the 2035 design year.

The Passing Lane Without Left-Turn Lane alternative does not satisfy this purpose and need criterion because multiple side-road movements from the higher-use intersections operate at LOS E or F in the 2035 design year.

The Passing Lane With Left-Turn Lane alternative performs measurably better because of the median refuge that is provided at a major intersection when left-turn lanes are provided along the mainline (19 of the 47 locations available for left-turn lanes). This refuge allows vehicles to complete a left turn as a two-stage maneuver. Even with this operational improvement, the Passing Lane With Left-Turn Lane alternative does not satisfy this purpose and need criterion because several movements at two intersections still operate at LOS E and F in the 2035 design year.

The Hybrid 4-Lane to County G, Passing Lane County G to County P alternative places an interchange at the highly used intersections of WIS 23 with County UU and County G and a J-turn at County W.²⁹ That combined with the median refuge provided at minor intersections substantially helps service levels at side-road intersections. Movements associated with the J-turn include the right turn out (LOS B) and the U-turn (LOS B). Although not analyzed, J-turns will modify the left-turn delays at 7 Hills Road, which may reduce driver frustration. This alternative satisfies the criterion for this project purpose component.

The 4-Lane Build On-Alignment alternative provides interchanges at County UU and County G and a J-turn at County W. That combined with the median refuge provided at other intersections substantially helps service levels at side-road intersections. Median refuges will be provided at all side-road intersections that have cross access on WIS 23, which includes more intersection refuges than with the other alternatives. Although not analyzed, J-turns will modify the left-turn delays at 7 Hills Road, County U, Sugarbush Road, County A, and County S, which may reduce driver frustration. This alternative satisfies the criterion for this purpose and need component.

5. Highway Geometric Characteristics

This section describes WIS 23 highway geometric characteristics including intersection geometrics, alignment, and cross section attributes such as clear zone and shoulder width. Note that the typical section portion of the 2010 FEIS text (as shown below and page 1-8 of the FEIS) incorrectly cited the shoulders as being 10 feet wide. According to the 45 percent design plans prepared by KL Engineering, west of County UU shoulders generally are 10 feet wide. In Fond du Lac County east of County UU, the shoulder varies from 3 to 8 feet in width with the majority being 8 feet wide. In Sheboygan County, the shoulder width ranges from 3 to 10 feet. Also note the 2010 FEIS text below references a weighted average traffic forecast that is no longer current; the revised forecasts discussed in criterion 4 now apply. For a discussion on updated traffic forecast methodology, see the discussion in Appendix A.

The 2010 FEIS project purpose for the proposed actions that pertain to purpose and need criterion 5 includes the following:

- *Improve the highway facility to meet current design standards for this Corridors 2020 and Connections 2030 State Highway Plan Connector route in Wisconsin.*

The 2010 FEIS project need expressed the following needs regarding highway geometric characteristics of the WIS 23 corridor. The 2010 FEIS discussion regarding highway geometry includes the following.

Roadway factors, such as type of facility, lane widths, shoulder widths, lateral clearances, and horizontal and vertical alignments, influence the capacity of the road. These factors are discussed here.

²⁹ Note: J-Turns are not used in the Passing Lane alternatives because they require a large median to accommodate the turning radii for trucks making a U-turn.

1. Typical Sections

Existing WIS 23 is a two-lane rural roadway with bituminous pavement that has 12-foot-wide lanes and 10-foot shoulders. Generally the clear zones are about 22 feet in cuts and 45 feet in fills. While these geometric characteristics of the existing highway are adequate for a two-lane facility, traffic volumes warrant a multilane facility to meet current and future capacity needs. When the ADT exceeds 8,700, the desirable standard for a rural 2020 Connector route is a four-lane facility. The existing average weighted ADT for WIS 23 within the project limits is 8,150 and forecasted volumes are projected to exceed this threshold.

2. Horizontal and Vertical Geometrics

The overall horizontal and vertical geometrics generally fall within WisDOT standards. However, the locations of side roads and access points intersect many of the curves in less than optimal locations. These horizontal and vertical curves, in combination with the existing terrain, make approximately 22 percent (average) of the roadway being designated as no passing zones. Even when passing zones are available, traffic volumes often prevent passing opportunities on the remaining roadway because of the opposing vehicles. The inability to pass restricts speed and maneuverability for through-traffic.

3. US 151/WIS 23 Connection

The connection between the US 151 Fond du Lac bypass and WIS 23 joins two Connector routes in the State Highway Plan. Typically connections between highways with this classification have “system” interchanges with free-flowing ramps. This higher level connection emphasizes the importance of safety and mobility between the two highways. Currently, this connection is serviced by at-grade signalized intersections at the terminals of a diamond interchange. As traffic volumes grow, it will become more important for this connection to be consistent with these two roadway classifications. Because US 151 is designated a Connector route to the south of WIS 23, and WIS 23 is designated a Connector route to the east of US 151, the free-flowing ramps would serve the northbound-to-eastbound and westbound-to-southbound movements only.

Note that while the 2010 FEIS noted the US 151/WIS 23 connection and a possible future system interchange as a need, the FEIS also selected the No Corridor Preservation Option for the connection as the preferred alternative because of the adverse effects to businesses associated with mapping of a future system interchange. For this reason, this connection is not discussed in this technical memo.

Design Class

WIS 23 is a Connector Route in the Corridors 2030 plan. For a Corridors 2030 (formerly Corridors 2020) route, the design criteria for rural state trunk highways are held to a higher standard. One of the main design requirements of a Corridors 2030 route has to do with traffic operations. FDM 11-5-3.2 provides the operational goals for Corridors 2030 routes. They are defined by Level of Service (LOS).³⁰ The operational goal for WIS 23, a Corridors 2030 Connector, is LOS C, meaning the LOS on this route is expected to remain at LOS C or below LOS 4.0 on the numerical scale discussed in FDM 11-5-3.³¹ Refer to criterion 4 for more details. The cross-sectional requirements related to a Corridors 2030 route are directly connected to their ability to satisfy the operational goals for the Design Class. Attachment 1.1 in the FDM 11-15 illustrates Design Criteria by Design Class. Information includes Design Average Annual Daily Traffic (AADT), design speed, traveled way width, shoulder width, and roadway width. The Design Classes are divided into four categories: A1, A2 (2 lanes), A3 (4-lane divided), and A4 (6-lane divided). For each Design Class, there are AADT guideline ranges³² that are related to operational expectations for freeway Backbone routes, non-freeway Backbone and Connector Routes, and principal arterials. Table 5-1 shows FDM 11-15 Attachment 1.1.

³⁰ LOS describes the operation, or congestion levels, of a roadway. It ranges from LOS A (good) to LOS F (very poor). The 2010 Highway Capacity Manual (Transportation Research Board, 5th Edition, 2010) provides more detail on this rating system. It is also discussed to greater extent in criterion 4 of this technical memo.

³¹ Facilities Development Manual 11-5-3.2 (WisDOT, March 27, 2008, <http://roadwaystandards.dot.wi.gov/standards/fdm/11-05.pdf#d11-5>)

³² Average Annual Daily Traffic (AADT) is a measure used in the transportation engineering field, which is the total volume of vehicle traffic of a roadway for a year divided by 365 days. AADT is a useful and simple measurement of how much traffic a roadway carries.

Design Criteria For Rural State Trunk Highways Functionally Classified As Arterials (Level Terrain)							
Traffic Volume		Roadway Width Dimensions				Bridges	
Design Class	Design AADT	Design Speed (mph)	Traveled Way Width (feet)	Shoulder Width (feet)	Roadway Width (feet)	Minimum Design Loading	Clear Roadway Width of Bridges (feet) ^{2, 3}
A1	Under 3500	60	24	6	36	HS20	36
A2 ¹ (2 lanes)	3,500–8,700 ^A 3,500–15,000 ^C	60	24	10 (8)	44 (40)	HS20	44 (40)
A3 ¹ (4 lane divided)	8,700 ^A - 44,000 ^A 8,700 ^B - 53,500 ^B 15,000 ^C - 60,000 ^C	70 ⁴	2 @ 24	6LT (4) 10RT⁵	2 @ 40 (38)	HS20	2 @ 40
A3 ¹ (6 lane divided)	44,000 ^A - 69,000 ^A 53,500 ^B - 85,000 ^B 60,000 ^C - 90,000 ^C	70 ⁴	2 @ 36	10 LT & RT⁶	2 @ 56	HS20	2 @ 56

^A For non-freeway Corridors 2020 backbone and connector route, LOS threshold is C/D or 4.0.
^B For freeway Corridors 2020 backbone route, LOS threshold is C/D or 4.0.
^C For other principal and minor arterials, LOS threshold is D/E or 5.0.

Desirable values are shown in bold and minimum values are shown in parentheses.

¹ The top of the traffic volume range for design class A2 is 8,700 AADT for a Corridors 2020 route and 15,000 AADT for a non-corridors 2020 route. These volumes are based on the 2000 Highway Capacity Manual assuming; level terrain, 12-foot lanes, ≥ 6-foot shoulders, 80% passing, 10% trucks, K30 design factor, and 60/40 directional split. In cases where a reduced level of service is determined to be acceptable and the use of passing lanes is found to be adequate treatment for the facility, the 8,700 AADT value for C2020 Connector routes may be increased to 12,000 AADT. Design class A3 assumptions: level terrain, 12-foot lanes ≥ 6-foot shoulders, 10% trucks, K30 design factor, 61/39 directional split, 2 access points per mile, except freeway. See FDM 11-5-3 for additional information on level of service thresholds for different facility types and the respective numerical value.
² Normally provide full width of approach roadways across all new bridges. Exceptions may be made when the bridge is considered a major structure on which design dimensions are subject to individual economic studies because of high unit cost.
³ Lateral clearance requirements for underpass bridges are included in FDM 11-35-1.
⁴ See FDM 11-10-1.
⁵ Use a 12 ft paved shoulder (right) on 4-lane freeways if truck traffic >250 DHV, or if the facility experiences a high degree of congestion and incidents. The roadway width and clear roadway width on bridges are increased accordingly.
⁶ Use 12 ft paved shoulders (left & right) on 6-lane freeways if truck traffic > 250 DHV or if the facility experiences a high degree of congestion and incidents. The roadway width and clear roadway width on bridges are increased accordingly.

Table 5-1 FDM 11-15 Attachment 1.1

The Design AADT is the projected traffic volume forecast for the design year of the roadway, typically the construction year plus 20 years.³³ According to this Attachment 1.1, for an A2 (2 lanes) Design Class non-freeway Corridors 2020 Connector Route, WIS 23's current classification, the traffic volume guidance ranges from 3,500 to 8,700 AADT. For an A3 (4-lane divided highway) Design Class non-freeway Corridors 2020 Connector Route, the Design AADT guidance ranges from 8,700 to 44,000.

The Design AADT shown in Attachment 1.1 is a guideline based on LOS calculations for a generic roadway with generic characteristics. These Design AADT ranges provide guidance on the appropriate design classification. Actual classification is determined by the operational analysis for the design year. A footnote on Attachment 1.1 states the following.

¹
"The top of the traffic volume range for design class A2 is 8,700 AADT for a Corridors 2020 route and 15,000 AADT for a non-corridors 2020 route. These volumes are based on the 2000 Highway Capacity Manual assuming; level terrain, 12-foot lanes, ≥ 6-foot shoulders, 80% passing, 10% trucks, K30 design factor, and 60/40 directional split. In cases where a reduced level of service is determined to be acceptable and the use of passing lanes is found to be adequate treatment for the facility, the 8,700 AADT value for C2020 Connector routes may be increased to 12,000 AADT. Design class A3 assumptions: level terrain, 12-foot lanes ≥ 6-foot shoulders, 10% trucks, K30 design factor, 61/39 directional split, 2 access points per mile, except freeway. See FDM 11-5-3 for additional information on level of service thresholds for different facility types and the respective numerical value."

³³ Facilities Development Manual 11-10-1.1 (WisDOT, December 30, 2002, <http://roadwaystandards.dot.wi.gov/standards/fdm/11-10.pdf#fd11-10>)

This footnote indicates that the Design Classification is based on an LOS, and the thresholds provided for Design Classification are based on a generic highway segment. For WIS 23 the Design Classification, and corresponding number of lanes, is based on what is necessary to maintain LOS C (or numeric LOS below 4.0) in the design year for the specific WIS 23 roadway and traffic volume characteristics that factor into LOS calculations. This footnote also states that the threshold between Design Classifications may be increased to 12,000 AADT when passing lanes are used. Again, this is based on an operations analysis for a generic highway segment. The actual AADT threshold is based on the operations analysis for the subject highway. For WIS 23, the Design Classification, and corresponding number of lanes, is based on what is necessary to maintain LOS C (or numeric LOS below 4.0) with passing lanes and the given AADT traffic forecast. Individual roadway characteristics, such as peak-hour volume, directional distribution of traffic, lane and shoulder width, percent passing zone availability, access frequency, and truck percentage are all factors in the LOS calculation for the individual roadway. The discussion for criterion 4 provides a greater description of the factors used in determining LOS.

In the design year 2035, the traffic volumes on much of WIS 23 will create LOS that will warrant either a passing lane or a 4-lane cross section to meet the LOS C (or numeric LOS of less than 4.0) requirement for a Connector Route in the Corridors 2030 plan. If LOS C can be maintained with a 2-lane facility, Design Class A2 and a 60 mph design speed³⁴ apply. If a 2-lane facility cannot maintain LOS C in the design year, divided 4-lane alternatives are considered. If a divided 4-lane facility is needed to maintain LOS C, Design Class A3 and a 70 mph design speed apply. Criterion 4 discusses the operational objectives of WIS 23 in more detail.

Design Class Criteria

Horizontal and vertical alignment characteristics of a roadway are based on design speed. The design speed is used to determine the stopping sight distance, intersection sight distance, and other controlling alignment characteristics. For example, the stopping sight distance for an A2 Design Class with a 60 mph design speed is 570 feet. The stopping sight distance for an A3 Design Class with a 70 mph design speed is 730 feet. The respective stopping sight distances then control both horizontal curves as well as vertical curves on the roadway alignment.

The desirable roadway shoulder width for an A2 Design Class is 10 feet, with 8 feet being the minimum width. The desirable shoulder widths for Design Class A3 are 6 feet left and 10 feet right. The minimum shoulder widths for Design Class A3 are 4 feet left and 10 feet right. In Fond du Lac County, shoulder widths on the current 2-lane WIS 23 roadway vary from 3 feet to 8 feet with the majority of the shoulder width being 8 feet. In Sheboygan County, the shoulder varies from 3 to 10 feet wide.

A clear zone is the total roadside border area, starting at the edge of the traveled way, available for safe use by errant vehicles. Clear zones along WIS 23 vary from roughly 22 feet in cut sections to up to 45 feet in fill sections.³⁵ According to FDM 11-15 Attachment 1.9³⁶, the clear zone distance for a roadway is dictated by the Design Speed, Design AADT, and the slope of the foreslopes and backslopes. Based on the design speed of WIS 23 (A2 or A3), WIS 23 requires a 20- to 30-foot clear zone in cut sections depending on the backslope used (1:3 to 1:6 or flatter). WIS 23 also requires a 30- to 46-foot clear zone in fill sections, depending on the foreslope used (1:6 or flatter to 1:4). Attachment 1.9 states that clear zones may be limited to 30 feet for practicality and to provide a consistent roadway template. The clear zones along WIS 23 generally meet A2 and A3 design standards, and adequate clear zone distances can be provided under any of the build alternatives.

WIS 23 is frequently used by farm machinery and other slow-moving traffic which is affected by cross section. With a 2-lane highway, slow-moving traffic could impede through traffic, whereas a 4-lane highway would provide opportunities for through traffic to travel around the farm machinery. The farm machinery and other slow-moving traffic hinders through traffic since opposing traffic makes it difficult for vehicles to pass the slow-moving vehicles, even though much of the corridor is currently marked with passing zones. The effect of slow-moving vehicles such as farm machinery, recreational vehicles, and trucks is discussed under criterion 2b.

³⁴ The design speed is a selected speed used to determine geometric design features of a roadway such as cross section, horizontal alignment/curves, sight distance, and cross section. Desirable Design Speed is 5 mph greater than the posted speed.

³⁵ Based on 45 percent completion plan produced by KL Engineering for WIS 23 in Fond du Lac County.

³⁶ Facilities Development Manual, 11-15 Attachment 1.1 (WisDOT, March 27, 2008; <http://roadwaystandards.dot.wi.gov/standards/fdm/11-15-001att.pdf#fd11-15a1.1>)

Purpose and Need Screening

The following question indicates how well an alternative satisfies the **Highway Geometric Characteristics** criterion of the project purpose and need.

a) Does the alternative incorporate the appropriate design criteria for the roadway classification?

Criteria	No Build	Passing Ln w/o Lt Turns	Passing Ln w/ Lt Turns	Hybrid 4-Ln to G Passing Ln G to P	4-Lane Build On-Alignment
Design Class	A2	A2	A2	A3 and A2	A3
Design Speed	60 mph	60 mph	60 mph	70 mph to G, 60 mph east of G	70 mph
Horizontal Alignment Satisfy SSD for Design Speed?	Yes	Yes	Yes	Yes	Yes
Vertical Alignment Satisfy SSD for Design Speed?	Yes	Yes	Yes	Yes	Yes
Intersection Sight Distance Provided?	Not Evaluated	Yes	Yes	Yes	Yes
Appropriate clear zone provided?	Generally	Yes	Yes	Yes	Yes
Number of Lanes	2	2+	2+	4 to G, 2+ east of G	4
Inside Shoulder	NA	NA	NA	6 feet to G, NA east of G	6 feet
Outside Shoulder	3 to 8 feet Does not currently meet 8' minimum shoulder	8 feet	8 feet	10 feet to G 8 feet east of G	10 feet
LOS C Maintained in 2035 with Lanes Provided?	No See criterion 4	Yes See criterion 4	No See criterion 4	No See criterion 4	Yes See criterion 4
Satisfy Geometric Criterion?	No	Partially (Does not maintain LOS C in 2035)	Partially (Does not maintain LOS C in 2035)	Partially (Does not maintain LOS C in 2035)	Yes

Table 5-2 Geometric Screening

6. Access Management

The **2010 FEIS project purpose** objectives for the proposed action that pertain to purpose and need criterion 6 include the following.

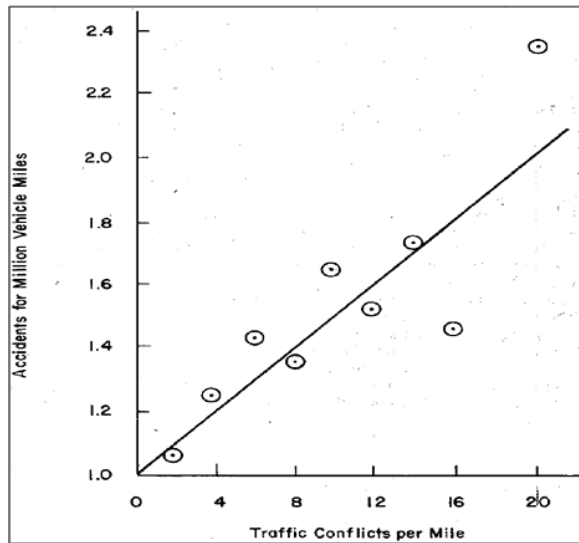
- *Increase the mobility by... minimizing public and private access.*
- *Preserve R/W needed for future grade separations and interchanges so future safety improvements are easily implemented*
- *Provide a safe and dependable highway connection... while reducing conflicts between local and through traffic.*

The **2010 FEIS project need** expressed the following needs regarding access.

"F. Access

In August of 1989, WisDOT adopted a statewide access plan for managing access on the state highway system. The purpose of the access plan is to provide a high LOS for through traffic and increase safety while providing reasonable access to abutting properties. The plan seeks to balance public investments in highway improvements, land development, tax base growth, and job creation. The plan identifies Corridors 2020/Connections 2030 Backbone and Connector routes, like WIS 23, as a group of highways for which managed access is deemed essential to maintaining a required high LOS and safety.

There is a direct relationship between access points and crashes. Figure 1.3-4 shows a graph from the American Association of State Highway Officials Policy on Geometric Design³⁷ that shows the correlation of conflicts per mile versus the crash rate on rural highways. As access points increase, so does the crash rate. Driveways for residential and commercial properties as well as side roads are located along the entire 19-mile WIS 23 route. There are 235 access points within the project limits, which are summarized in Table 1.3-5. This amounts to approximately 12.3 access points per mile. Excluding driveways and farm entrances, WIS 23 has 67 access points, which is about 3.5 points per mile. The mean access density (without driveways) for a Connections 2030 Connector route is 2.9 access points per mile.



FEIS Figure 1.3-4 Relationship between Access Points and Crash Rates

Vehicles entering and exiting WIS 23 at the numerous access points interrupt the flow of traffic. Drivers must adjust their travel speed to accommodate entering and exiting vehicles, and each access point creates potential for conflict and subsequent crashes.

Existing WIS 23 Access Summary			
Access Type	No. of Access Points	WIS 23 Access Density (per mile)	Mean Access Density for 2030 Connector Route
State Trunk Highway Intersections	0	0	--
County Trunk Highway Intersections	16	0.8	--
Local Roads and Street Intersections	51	2.7	--
Subtotal	(67)	3.5	2.9
Commercial, Residential Driveways	95	5	--
Field Entrances	73	3.8	--
TOTAL	235	12.3	--

FEIS Table 1.3-5

³⁷ A Policy on the Geometric Design of Highways and Streets, 1990, American Association of State Highway and Transportation Officials (AASHTO)

WisDOT Access Policy

FDM 7-5-1 describes the State Access Management Plan (SAMP).³⁸ It was adopted as part of the Connections 2030 statewide long-range multimodal transportation plan in October of 2009 and defines the vision and policy for appropriate access on Wisconsin's state trunk highway system. Table 6-1 illustrates the first two rows of FDM 7-5-1 Table 1.1. It lays out the following goals for new access allowed on Tier 1 and Tier 2A routes. The portion of the WIS 23 corridor discussed in this document is a Tier 2A route since it is not a freeway or Corridors 2030 backbone route.

Goal for Access and Traffic Movement	Type of New Access Allowed
Tier 1 - Maximize Interstate/Statewide Traffic Movement <ul style="list-style-type: none"> – Generally reserved for C2020 Backbone and Connector routes. – High percentage designed/planned for expressway or freeway standards. 	Safely spaced at constructed or planned grade separated locations. Locked/gated driveways for emergency vehicles. Plan in place for ultimate removal of all private access.
Tier 2A - Maximize Interregional Traffic Movement – High Volume <ul style="list-style-type: none"> – High percentage is C2020 Backbone and Connector routes, but also includes significant number of other routes. – Most are constructed/planned for 4-lane capacity. Expressway standards are highly desirable. 	At-grade public road intersections, with interchanges at higher volume routes. Locked/gated driveways for emergency vehicles. No at-grade intersections within 1 mile of interchange entrance ramps. See FDM 11-5-5 for spacing.

Table 6-1 FDM 7-5-1 Table 1.1 Guidelines for New Access Points (First two rows)

WisDOT provides recommended access densities for various functional classifications of intersecting roads with rural principal arterials in FDM 11-5, Attachment 5.1.³⁹ For nonexpressway rural principal arterials, the recommended maximum density is 5.3 private access points per mile (based on a minimum spacing of 1000 feet between private access points). For expressway principal arterials, this drops to 2.6 private access points per mile. WIS 23 currently averages 8.8 private access points per mile.

FDM 7-5-1 states the following regarding guidelines for existing access points.

“When an existing access point does not meet the desired level of access control identified in the SAMP, it is often because no reasonable alternative access exists (a side road, for example) or no opportunity to obtain an alternative access exists. In response, decision and actions will consider the following:

- Alter all existing access points to meet departmental and operational safety standards as opportunities arise.*
- Develop a long-term plan to remove existing hazardous access points when opportunities arise.*
- Restrict access with a covenant, a formal sealed contract or agreement. When a property is restricted access via covenant, its owners will not be granted further access beyond what the agreement indicated.*

The SAMP recommends that all access decisions balance current needs with safety risks and be consistent with the defined access management system. WisDOT will work with the general public and local governments to achieve a safe and efficient state trunk highway system in the public interest.”

³⁸ Facilities Development Manual 7-5 (WisDOT; December 22, 2011; <http://roadwaystandards.dot.wi.gov/standards/fdm/07-05.pdf#fd7-5-1>)

³⁹ Facilities Development Manual 11-5, Attachment 5.1 (WisDOT, December 30, 2002; <http://roadwaystandards.dot.wi.gov/standards/fdm/11-03-005att.pdf#fd11-3a5.1>)

Access Management Mechanisms

WisDOT will use the provisions of Wisconsin State Statute 84.295, along with other access management tools, to assist in managing access along WIS 23. This statute allows WisDOT to designate roadways as freeways and expressways and then preserve right of way and manage access through the publishing of an official map. An official map, which is recorded at the register of deeds, lays out future right of way needed as well as future access conditions for the proposed highway. It alerts landowners of potential highway projects that will affect their property. Also, prior to improving their property within an area that is officially mapped under 84.295, the landowner must notify WisDOT of the improvement plans. WisDOT may then choose to purchase the right of way at that time or wait until the highway improvement is actually implemented.

This law is a powerful planning and preservation tool for access management. Statute 84.295 allows a fully developed freeway/expressway concept to be approved and legally recorded without requiring it to be implemented as a project with right of way acquisition and construction at a specific time in the future.

The following paragraphs excerpted from FDM 7-40-1.4⁴⁰ discuss the authorities granted under this law that apply to the WIS 23 corridor

“1.4 Authorities Granted Under §84.295

. . . Empowers the department to construct grade separations at intersections with other public highways and railroads and to change or adjust the lines of public highways and if necessary combine, relocate or extend the same to adjust traffic service to grade separation structures. Ref: s. 84.295(6)

. Empowers the department by agreement to relocate, extend, or close at a point near the intersection with the freeway or expressway, any highway or make provision for carrying such highway over or under the freeway or expressway. Ref: §84.295 (7)(a). This paragraph does not limit the authority of the department under s. 84.295(6) to construct grade separations without such an agreement, as mentioned above.

. . . . Allows the department to grant or deny access requests for public road connections to the freeway or expressway and to place terms and conditions on such connections as the department deems will best serve the public interest. Ref: s. 84.295(7)(b)”

WisDOT would use this statute on WIS 23 to:

- Officially map future interchanges and overpasses.
- Officially map future road closures.
- Officially map local road alterations needed for above.

For private access management, including the removal of driveways, WisDOT uses the provisions of Wisconsin State Statute 84.09 to purchase access. This law allows lands or land interests, including access rights, needed for highway purposes to be purchased by WisDOT. 84.09 is typically used when:

- New or additional lands are being acquired.
- The access rights to a parcel have measurable value.
- Changes in current access or the elimination of access is necessary.

WisDOT would use this statute to eliminate or relocate private access points on WIS 23 where possible or feasible.

WisDOT uses its powers to alter access arrangements within the highway right of way to eliminate hazardous movements. Hazardous movements include movements that cross WIS 23 through traffic or impede WIS 23 through movement. Hazardous movements are typically associated with access and

⁴⁰ Facilities Development Manual 7-40-1 (WisDOT, February 25, 2011; <http://roadwaystandards.dot.wi.gov/standards/fdm/07-40.pdf#fd7-40-1>)

examples include left turns from side roads, left turns from the WIS 23 mainline, and crossing movements from the side road. Examples of access modifications include:

- Installation of an interchange at an intersection.
- Installation of a grade separation that allows access across, but not to, a state highway.
- Installation of a median that restricts access to right-in/right-out.
- Removal of a median opening.
- Restricting intersection access to left-in, right-in, and right-out only.
- Installation of a J-turn.
- Removing existing access points.
- Combining existing access points.

For WIS 23, all the above measures would be used to eliminate hazardous movements. Some of these measures are only able to be applied to a 4-lane facility. For example, WisDOT only constructs interchanges on 4-lane divided highways because it has had poor safety results with installing interchanges on 2-lane roadways. Interchanges on 2-lane roadways have resulted in crashes as drivers completing their merging maneuvers from the on-ramp mistakenly assumed they were on a divided 4-lane roadway and used the actual opposing lane as a travel lane. Another measure that is not feasible on 2-lane highways are J-Turns because a median is required to accommodate the turning radii needed by trucks to make a U-turn.

Private access points tend to have fewer turning and crossing movements associated with them because they serve fewer parcels. Because they typically have a tenth (or less) of the turning movements, they do not have as great a crash potential as a side-road intersection. WisDOT still seeks to reduce the number of private access points and would determine the feasibility of access point removal on a case-by-case basis. With the purchase of right of way, WisDOT often can provide alternate access to parcels or combine access points, allowing the removal of access from WIS 23. When right of way is not purchased, there are fewer opportunities to provide alternate access to parcels. Determination of private access removal will be made during design.

Purpose and Need Screening

The following questions are used to determine how well an alternative satisfies the **Access** purpose and need criterion.

a) Does the alternative reduce the number of hazardous movements (left turns or crossing from sideroads) at public access points through the installation of access restrictions or interchanges?

Table 6-2 summarizes the access treatments associated with each alternative. At-grade access has the highest number of hazardous movements. The provision of left-turn lanes on WIS 23 only marginally reduces this. The installation of cul de sacs, interchanges, or J-Turns are the most effective in reducing hazardous maneuvers.

Table 6-2 Intersection Access Treatment for Each Alternative					
Intersection	Access Treatment (RI/RO = right in/right out)				
	No-Build	Passing Ln w/o Lt Turns	Passing Ln w/ Lt Turns	Hybrid 4-Ln to G Passing Ln G to P	4-Lane Build On-Alignment
Wisconsin American Drive	At-grade	Multi-Lane Roundabout	Multi-Lane Roundabout	Multi-Lane Roundabout	Multi-Lane Roundabout
County K	At-grade	Jug-handle	Jug-handle	Jug-handle	Jug-handle
Mary Hill Drive	At-grade	At-grade	At-grade	Access removed	Access removed
Whispering Springs Drive	At-grade	RI/RO	RI/RO	RI/RO	RI/RO
HillTop Drive	At-grade	Cul-de-sac	Cul-de-sac	Cul-de-sac	Cul-de-sac
Northway Road	At-grade	At-grade	At-grade	Access removed	Access removed
County UU	At-grade	At-grade	At-grade	Diamond Interchange	Diamond Interchange
Taft Road	At-grade	At-grade	At-grade	RI/RO	RI/RO
Tower Road North	At-grade	At-grade	At-grade	J-turn	J-turn

Table 6-2 Intersection Access Treatment for Each Alternative					
Intersection	Access Treatment (RI/RO = right in/right out)				
	No-Build	Passing Ln w/o Lt Turns	Passing Ln w/ Lt Turns	Hybrid 4-Ln to G Passing Ln G to P	4-Lane Build On-Alignment
			w/left-turn lanes		
Tower Road South	At-grade	At-grade	At-grade w/left-turn lanes	RI/RO	RI/RO
Poplar Road North	At-grade	At-grade	At-grade	RI/RO	RI/RO
Poplar Road South	At-grade	At-grade	At-grade	RI/RO	RI/RO
7 Hills Road North	At-grade	At-grade	At-grade w/left-turn lanes	J-turn	J-turn
7 Hills Road South	At-grade	At-grade	At-grade w/left-turn lanes	J-turn	J-turn
Hinn Road	At-grade	At-grade	At-grade w/left-turn lanes	RI/RO	RI/RO
County W South	At-grade	At-grade	At-grade w/left-turn lanes	J-turn	J-turn
County W North	At-grade	At-grade	At-grade w/left-turn lanes	J-turn	J-turn
Loehr Rd	At-grade	At-grade	At-grade w/left-turn lanes	RI/RO	RI/RO
Log Tavern Road North	At-grade	At-grade	At-grade	At-grade T-intersection	At-grade T-intersection
Log Tavern Road South	At-grade	At-grade	At-grade	Cul-de-sac	Cul-de-sac
Triple T	At-grade	At-grade	At-grade	Rerouted to Pit Road South	Rerouted to Pit Road South
Pit Rd North	At-grade	At-grade	At-grade	At-grade Intersection	At-grade Intersection
Pit Rd South	At-grade	At-grade	At-grade	At-grade Intersection	At-grade Intersection
Banner Rd	At-grade	At-grade	At-grade	Cul-de-sac	Cul-de-sac
Triple T Rd North	At-grade	At-grade	At-grade	At-grade T-intersection	At-grade T-intersection
Hillview Rd North	At-grade	At-grade	At-grade	RI/RO with Dedicated Left In	RI/RO with Dedicated Left In
Hillview Rd South	At-grade	At-grade	At-grade	RI/RO	RI/RO
Hickory Road	At-grade	At-grade	At-grade	Cul-de-sac	Cul-de-sac
County G	At-grade	At-grade	At-grade w/left-turn lanes	Diamond Interchange	Diamond Interchange
Division Rd North	At-grade	At-grade	At-grade	At-grade	Cul-de-sac
Division Rd South	At-grade	At-grade	At-grade	At-grade	Access Road to County G
Chickadee Dr	At-grade	At-grade	At-grade	At-grade	RI/RO
County U	At-grade	At-grade	At-grade w/left-turn lanes	At-grade or At-grade w/left-turn lanes	J-turn
Sunrise Rd	At-grade	At-grade	At-grade	At-grade	At-grade T-intersection
Spring Valley Dr	At-grade	At-grade	At-grade	At-grade	At-grade T-intersection
Scenic View Dr North	At-grade	At-grade	At-grade	At-grade	At-grade Intersection
Scenic View Dr South	At-grade	At-grade	At-grade	At-grade	At-grade Intersection
County T	At-grade	At-grade	At-grade w/left-turn lanes	At-grade or At-grade w/left-turn lanes	J-turn
Plank Rd–West	At-grade	At-grade	At-grade	At-grade	RI/RO
Sugarbush Road	At-grade	At-grade	At-grade	At-grade	RI/RO with

Table 6-2 Intersection Access Treatment for Each Alternative					
Intersection	Access Treatment (RI/RO = right in/right out)				
	No-Build	Passing Ln w/o Lt Turns	Passing Ln w/ Lt Turns	Hybrid 4-Ln to G Passing Ln G to P	4-Lane Build On-Alignment
North					Dedicated Left In – J-turn
Sugarbush Road South	At-grade	At-grade	At-grade	At-grade	RI/RO with Dedicated Left In – J-turn
County A North	At-grade	At-grade	At-grade w/left-turn lanes	At-grade or At-grade w/left-turn lanes	J-turn
County A South	At-grade	At-grade	At-grade w/left-turn lanes	At-grade or At-grade w/left-turn lanes	J-turn
Plank Rd–East	At-grade	At-grade	At-grade	At-grade	RI/RO
Castle Rock Court	At-grade	At-grade	At-grade	At-grade	At-grade Intersection
Julie Court West	At-grade	At-grade	At-grade	At-grade	At-grade Intersection
Julie Court East	At-grade	At-grade	At-grade	At-grade	Cul-de-sac
Ridge Rd North	At-grade	At-grade	At-grade	At-grade	Cul-de-sac
Ridge Rd South	At-grade	At-grade	At-grade	At-grade	At-grade T-intersection
County S North	At-grade	At-grade	At-grade w/left-turn lanes	At-grade or At-grade w/left-turn lanes	J-turn
County S South	At-grade	At-grade	At-grade w/left-turn lanes	At-grade or At-grade w/left-turn lanes	J-turn
Coary Lane	At-grade	At-grade	At-grade	At-grade	Removed from WIS 23– Sandstone Lane extended and cul-de-sac
Twinkle Lane	At-grade	At-grade	At-grade	At-grade	Removed from WIS 23–Valley Lane extended and cul-de-sac
County P North and South	At-grade	At-grade	At-grade w/left-turn lanes	At-grade w/left-turn lanes	At-grade intersection
Inez St	At-grade	At-grade	At-grade	At-grade	At-grade T-intersection
Branch Road	At-grade	At-grade	At-grade	At-grade	Removed from WIS 23– Extended to Inez Court
Hazardous Movement Removed from Sideroad?	No	No	No	Partially	Yes

Table 6-2 Intersection Access Treatment for Each Alternative

b) Does the alternative reduce the number of private access points through right of way acquisition?

Defining the exact number of private access points reduced is not possible until the real estate process is complete. All build alternatives will attempt to reduce the number of access points during acquisition of the needed right-of-way.

The No-Build alternative does not reduce the number of private access points.

The Passing Lane Without Left-Turn Lanes alternative partially satisfies this purpose and need criterion because it would eliminate or combine a few private access points.

The Passing Lane With Left-Turn Lanes alternative partially satisfies this purpose and need criterion because it would eliminate or combine a few private access points.

The Hybrid 4-Lane to County G, Passing Lane County G to County P alternative partially satisfies this purpose and need criterion because it would eliminate many private access points from USH 151 to County G. With this alternative right of way would be acquired from County K to County G, giving more opportunity to combine and realign access points to side roads. From County G to County P, this alternative would eliminate a few private access points.

The 4-Lane Build On-Alignment alternative would fully satisfy this purpose and need criterion because it would eliminate or combine many private access points along the length of the project. With this alternative right of way would be acquired for the full corridor length giving more opportunity to combine and realign access points to side roads.

c) Does the alternative designate and preserve land for future access modifications, such as overpasses and interchanges, through official mapping?

The No-Build alternative does not designate or preserve land for future access modifications.

All build alternatives will designate and preserve land for future access modifications.

7. Safety

The 2010 FEIS included several paragraphs describing highway safety. To ensure that the Limited Scope Supplemental EIS reflected up-to-date data, the crash information was made current with 2009 and 2010 crash data. Also, since the time the crash analysis was performed in the 2010 FEIS, WisDOT changed its method of reporting average state crash rates. The new methodology increased the number of roadway classifications used to report statewide crash rates. The new methodology also only provides 5-year rolling averages rather than the yearly averages that were previously reported. Because of these changes, it is not possible to duplicate the 2010 FEIS data for the crash update that will be presented in the Limited Scope Supplemental EIS. However, the more recent crash data is analyzed and applied to the WIS 23 corridor.

The 2010 FEIS project purpose for the proposed action that pertains to purpose and need criterion 7 includes the following:

*“The purpose of the proposed action is to provide additional highway capacity to serve existing and projected traffic volumes and **improve** operational efficiency and **safety** for local and through traffic while avoiding or minimizing environmental effects.*

- *Provide a **safe** and dependable highway connection to and from regional communities while reducing conflicts between local and through traffic.*
- *Improve **safety** at intersections and farm crossings.*

The 2010 FEIS project need expressed the following needs regarding safety on the WIS 23 corridor

“G. Safety

A crash study report prepared for WIS 23 between County K and County P analyzed crashes from 2001 to 2008. A total of 308 nondeer crashes occurred during the 8-year study period. Crash rates are compared to Statewide Average Crash Rates for rural state trunk highways. FEIS Table 1.3-6 summarizes rural crashes from County K to County P.

Summary of Rural Highway 23 Crashes Not Including Deer						
	Fatal Crash Rate		Injury Crash Rate		Total Crash Rate	
Year	WIS 23	STATE	WIS 23	STATE	WIS 23	STATE
2001	1.9	1.5	41	42	76	104
2002	0.0	1.7	35	42	63	106
2003	0.0	1.8	48	46	87	117
2004	0.0	1.7	43	47	91	121
2005	1.9	1.6	33	43	59	115
2006	3.7	1.7	35	43	69	109
2007	0.0	1.5	39	44	76	118
2008	0.0	1.3	15	43	50	130
Average	0.9	1.6	36	44	71	115
Crash rates are expressed as the number of crashes per 100 million vehicle miles.						

FEIS Table 1.3-6

In the study corridor, deer crashes accounted for 57 percent of the total number of rural crashes (an additional 406 crashes). Common types of nondeer crashes in rural areas included run-off-the-road at 30 percent, angle crashes at 24 percent, rear-end crashes at 19 percent, and sideswipes at 13 percent.

The WIS 23 crash rate within the project limits is less than the statewide rates. While the WIS 23 crash rate is lower, increases are expected as the traffic increases. Roadways carrying similar traffic volumes to WIS 23 typically fall into a higher roadway classification that has lower crash rates.

WIS 23 Crash Data Update

Table 7-1 updates the FEIS Table 1.3-6 with the years 2009 and 2010. Statewide yearly average crash rates are not reported for the reasons previously discussed.

Summary of Rural Highway 23 Crashes Not Including Deer						
	Fatal Crash Rate		Injury Crash Rate		Total Crash Rate	
Year	WIS 23	STATE	WIS 23	STATE	WIS 23	STATE
2001	1.9	1.5	41	42	76	104
2002	0.0	1.7	35	42	63	106
2003	0.0	1.8	48	46	87	117
2004	0.0	1.7	43	47	91	121
2005	1.9	1.6	33	43	59	115
2006	3.7	1.7	35	43	69	109
2007	0.0	1.5	39	44	76	118
2008	0.0	1.3	15	43	50	130
2009	0.0	NA	18	NA	68	NA
2010	0.0	NA	27	NA	55	NA
Average	0.7	NA	33	NA	69	NA
Crash rates are expressed as the number of crashes per 100 million vehicle miles.						

Table 7-1 Summary of WIS 23 Crashes

The updated crash study report prepared for WIS 23 between County K and County P provided an analysis of crashes for five years from 2006 to 2010. A total of 172 nondeer crashes occurred during the 5-year analysis period. Overall, the corridor had a 5-year average crash rate of 60 crashes per 100 million vehicle miles traveled. Crash rates are compared to Statewide Average Crash Rates for rural state trunk highways. Table 7-2 summarizes rural crashes from County K to County P by segment. The analysis looked at individual segments so that areas where safety concerns exist can be identified and appropriate countermeasures investigated.

WIS 23 Segment	Fatal Crash Rate		Injury Crash Rate		Total Crash Rate	
	WIS 23	2006-2010 Statewide	WIS 23	2006-2010 Statewide	WIS 23	2006-2010 Statewide
County K to County UU	0	0.9	38.2	24.7	99	67
County UU to 7 Hills Road	0	1.3	25.4	28.2	51	70
7 Hills Road to County W/Hinn	0	1.3	6.2	28.2	68	70
County W/Hinn to County W/ Loehr	0	1.3	78.6	28.2	144	70
County W/Loehr to Hillview Road	2.3	1.3	9.1	28.2	18	70
Hillview Road to County G	0	1.3	25.3	28.2	88	70
County G to County T North	0	1.3	26.2	28.2	48	70
County T North to County P/ Pioneer	1.7	1.3	32.2	28.2	85	70
Corridor County K to County P	0.7	1.3	26.0	28.2	63	70
Crash rates expressed as the number of crashes per 100 million vehicle miles traveled Shaded cells indicate areas with higher crash rates than the state average.						

Table 7-2 Summary of Rural WIS 23 Crashes Not Including Deer (2006-2010 Analysis)

While the overall corridor crash rate is slightly below the statewide average for a 2-lane rural highway, there are sections at both ends and at the center of the corridor that have higher crash frequencies. Also, the area between the County W intersections shows a very high crash rate; this is likely because through movements on County W need to turn right, travel on WIS 23, and then turn left. Figure 7-1 illustrates the 5-year crash rates on sections of WIS 23 compared to the 5-year statewide average crash rate for a 2-lane rural roadway.⁴¹

Of the 172 reported crashes from 2006 to 2010, the most frequent types of crashes are angle (24 percent) and run-off-the-road (29 percent). Table 7-3 lists the types and percentages of crashes that occurred.

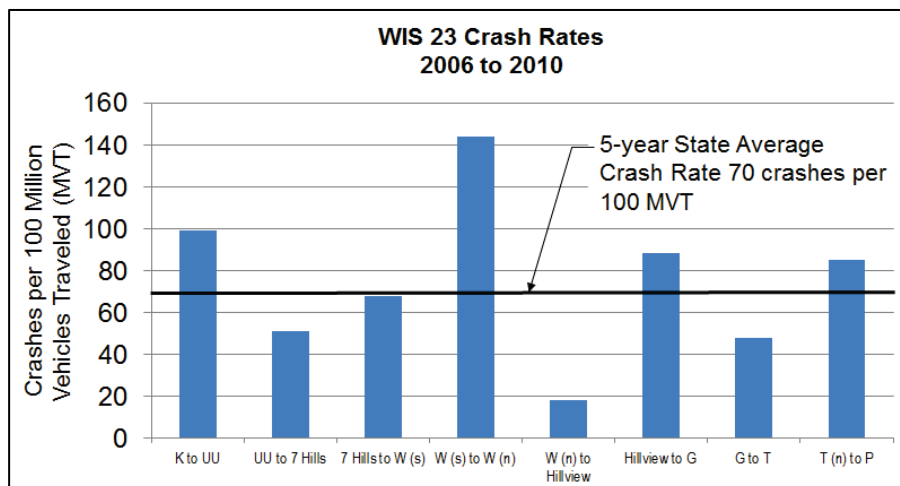


Figure 7-1 WIS 23 Total Crash Rate Compared to Statewide Average Crash Rate

⁴¹ Note that the FEIS provided crash data for 8 years, from 2001 to 2008. In 2009, WisDOT instituted a new method of crash data comparison that changed the facility type categories and used a 5-year average. Therefore only 5-year crash comparisons are now possible.

Number	Percent of Total	Type
7	4%	Head-On
13	8%	Sideswipe Traveling Opposite Direction
10	6%	Sideswipe Travelling Same Direction
42	24%	Angle (of which 32 occurred at intersections)
33	19%	Rear End (of which 6 involved stopped left-turning vehicles and 15 involved slowing vehicles making a turn)
50	29%	Run-off-the-Road
17	10%	Other
Total = 172		

Table 7-3 Crash Type Frequency

Of the 172 nondeer crashes that occurred from 2006 to 2010, 78, or 45 percent, were associated with intersections. (Note: Intersection crashes span multiple crash types in Table 7-3, meaning many different crash types occurred at intersections.) Intersections introduce turning movements where vehicles must cross through WIS 23 traffic. Intersections also introduce left-turning vehicles waiting for a gap in traffic in the through travel lane that increase the opportunity for rear-end and sideswipe crashes. Intersections with the highest number of crashes from 2006 to 2010 correspond with intersections with the highest traffic volumes. Table 7-4 lists them.

Intersection	Number of Crashes 2006-2010
County K	4 crashes ⁴²
County G	12 crashes
County A	11 crashes
County UU	5 crashes
7 Hills Rd	6 crashes

Table 7-4 Intersection Crashes

On high priority Corridor 2030 Connector Routes such as WIS 23, it is desirable to reduce risk factors that contribute to crashes, particularly at intersections.

Safety Improvements (Countermeasures)

Safety improvements are often termed countermeasures because they counter specific safety deficiencies. WisDOT has always considered and incorporated countermeasures in highway improvements to address safety deficiencies. In recent years there have been studies and guides published that allow a more quantitative approach to safety evaluation. Two references that provide guidance on countermeasures to existing crash problems are the *2010 Highway Safety Manual*, published by American Association of State Highway and Transportation Officials⁴³; and the *2008 Desktop Reference for Crash Reduction Factors*⁴⁴ published by FHWA and based on report FHWA-SA-08-011. Information from these texts is referenced here to provide an understanding of the potential effectiveness of the countermeasures being incorporated in the alternatives that will be addressed in the Limited Scope Supplemental EIS.

The Highway Safety Manual outlines a process that allows highway designers to predict the safety effects of different geometric modifications. The process uses Crash Modification Factors (CMF). A CMF is a multiplicative factor used when calculating the expected number of crashes after implementing a given countermeasure at a specific site.

⁴² Note, prior to the US 151 bypass opening (2005-2007), County K had numerous crashes. From 2001 to 2010, the intersection experienced 25 crashes.

⁴³ *2010 Highway Safety Manual*, (American Association of State Highway and Transportation Officials, First Edition, 2010, <http://www.highwaysafetymanual.org/Pages/default.aspx>)

⁴⁴ *Desktop Reference for Crash Reduction Factors*, Report Number FHWA-SA-08-011; Bahar, Geni; Masliah, Maurice; Wolff, Rhys; Park, Pete; U.S. Department of Transportation, Federal Highway Administration (FHWA), Office of Safety; <http://safety.fhwa.dot.gov/tools/crf/resources/fhwasa08011/>

The 2008 Desktop Reference for Crash Reduction Factors uses Crash Reduction Factors (CRF). A CRF is the percentage crash reduction that might be expected after implementing a given countermeasure at a specific site.

The main difference between CRF and CMF is that CRF provides an estimate of the percentage reduction in crashes, while CMF is a multiplicative factor. Both terms are widely used in the field of traffic safety.⁴⁵ For the purposes of this technical memo, CMFs are converted to CRFs, for comparison sake, meaning they indicate the percent reduction of that type of crash the countermeasure may produce.

Table 7-5 shows the type of crashes experienced on WIS 23, the type of countermeasure that is being used to address that safety concern, and the associated crash reduction factor associated with that countermeasure. Note that the countermeasures are provided for comparison as an indication of the measure's effectiveness. To project crash reductions, the predictive methods discussed in the 2010 Highway Safety Manual must be used.

Crash Type	Number	Countermeasure	AASHTO CRF ^a	FHWA CRF ^c
Head-On	7	Install median	12% injury 18% non-injury	15%
Sideswipe, Opposite Direction	13	Install median	12% injury 18% non-injury	15%
Sideswipe, Same Direction	10	Install passing lanes	25%	25%
		Expand to 4 lanes	None given	35% ⁴⁶
Angle Crashes at Intersection	32	Install interchange	42%	None given
		Install J-turn	20%	18%
		Install median refuge	None given	27% ⁴⁷
Rear-End Crashes ^b	33	Install left-turn lane	48%	48%
Run-off-the-Road	50	Expanding shoulder beyond 6 feet	13%	4% (8') 18% (10')

^a converted from CMF
^b (of which 6 involved stopped left-turning vehicles and 15 involved slowing vehicles making a turn)
^c Note CRF provided typically apply to all crash types at an intersection. While the countermeasures target specific safety concerns, there is not a direct correlation between the CRFs provided and the specified crash type.

Table 7-5 WIS 23 Crash Types and Countermeasures

The listing in Table 7-5 is not exhaustive. There are numerous other countermeasures that were reviewed but not incorporated into the alternatives. Examples of countermeasures reviewed but not incorporated include:

- Cable guard—Addresses head-on and sideswipe opposite direction crashes (can only be installed on alternatives with a median).
- Centerline rumble strips—Address head-on and sideswipe opposite direction crashes.
- Shoulder rumble strips— Address run-off-the-road crashes.
- Restrict access to right-in/right-out only—Helps address angle crashes. (This countermeasure is not enforceable on alternatives that do not include a median.)

The countermeasures listed above were not incorporated into the alternatives because they were difficult to implement, were not the most effective treatment, or are not yet incorporated into WisDOT design practices. Further review of these countermeasures will occur during design.

⁴⁵ Mathematically stated, $CMF = 1 - (CRF/100)$. For example, if a particular countermeasure is expected to reduce the number of crashes by 23 percent (i.e., the CRF is 23), the CMF will be $1 - (23/100) = 0.77$.

⁴⁶ Assumed passing lanes in both directions

⁴⁷ Note, the Desktop Reference for Crash Reduction Factors specifies a CRF of 27% for all crash types and severities, rather than specific angle crashes.

Purpose and Need Screening

While the WIS 23 corridor has an overall crash rate that is less than the state average, there are sections of the corridor that experience higher than normal crash rates. With any road improvement it is important to address safety deficiencies to reduce crash potential; this includes WIS 23. Appropriate safety improvements are required whenever a roadway is reconstructed.

a) Does the alternative adequately address WIS 23 mainline safety?

Table 7-6 summarizes the safety countermeasures that are included with each alternative being considered.

Crash Type	No.	Countermeasure	No-Build	Passing Ln w/o Left-turn Ln	Passing Ln w/ Left-turn Ln	Hybrid 4-Ln to Cty G, Passing Ln Cty G to Cty P	4 Lane Build On-Alignment
Head On	7	Install median	No	No	No	Yes US 151 to Cty G No Cty G to Cty P	Yes
Sideswipe, Opposite Direction	13	Install median	No	No	No	Yes US 151 to Cty G No Cty G to Cty P	Yes
Sideswipe, Same Direction	10	Install passing lanes	No	Yes	Yes	Yes Cty G to Cty P	
		Expand to 4 Lanes	No	No	No	Yes US 151 to Cty G No Cty G to Cty P	Yes
Rear End Crashes Associated with Left Turn from Mainline	33 (6 lefts, 15 slowing veh)	Install left-turn lane	No	No	Yes	Yes US 151 to Cty G Possibly Cty G to Cty P	Yes
Run off Road	50	Expanding shoulder beyond 6 feet	No	Yes	Yes	Yes	Yes
Adequately Satisfy WIS 23 Mainline Safety Component of Purpose and Need?			No	Partially	Partially	Yes	Yes

Table 7-6 WIS 23 Mainline Safety Purpose and Need Screening Evaluation

b) Does the alternative address intersection safety?

Intersection safety is addressed by removing the intersection access point or providing countermeasures for angle crashes. This purpose and need criterion is strongly related to the access management criterion 6, and the removal of access points was addressed in that section.

Table 7-7 summarizes the safety countermeasures to reduce angle crashes for each alternative considered.

Crash Type	No.	Counter Measure	No-Build	Passing Ln w/o Left-turn Ln	Passing Ln w/ Left-turn Ln	Hybrid 4-Ln to Cty G, Passing Ln Cty G to Cty P	4 Lane Build On-Alignment
Angle Crashes at Intersection	32	Install Interchanges	No	No	No	2 locations	2 locations
		Install J-turn	No	No	No	2 locations	6 locations
		Install Median Refuge	No	No	Yes	Partially to Cty G	Yes
Address Intersection Safety Component of Purpose and Need?			No	No	Partially	Partially	Yes

Table 7-7 WIS 23 Intersection Countermeasures for Angle Crashes

8. Accommodations for Non-Motorized Travel

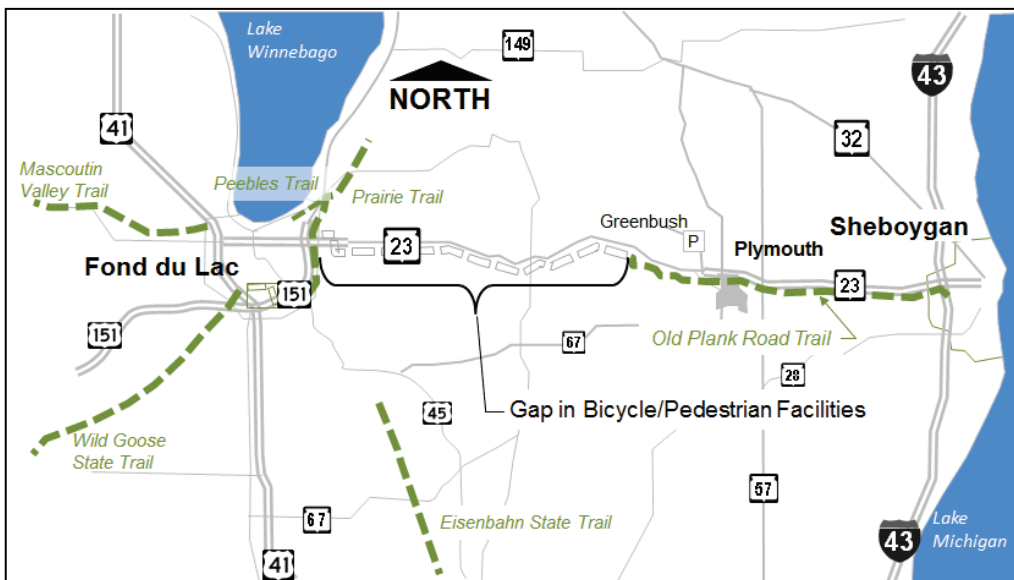
The 2010 FEIS project purpose for the proposed action that pertain to purpose and need criterion 8 include the following:

- *Preserve the corridor for future transportation needs by coordinating local governmental land use plans with transportation improvement plans. These plans include non-motorized transportation accommodations.*
- *Provide accommodations for non-motorized transportation.*

The 2010 FEIS project need expressed the following needs regarding bicycle and pedestrian accommodations on the WIS 23 corridor.

"H. Accommodations for Non-Motorized Travel

There are currently no adequate facilities for non-motorized transportation along WIS 23 between the Town of Greenbush and the City of Fond du Lac. Currently, the urban area of Fond du Lac is served by the multiuse Prairie Trail that travels around the perimeter of the city on the US 151 right of way. This trail connects the Wild Goose State Trail south of the city and the WIS 149 trail in Peebles. In Sheboygan County, the Old Plank Road Trail extends 17 miles from Sheboygan west to Greenbush and connects with the Kettle Moraine State Forest. This leaves a 16-mile gap along the WIS 23 corridor between Fond du Lac and Greenbush where no satisfactory facilities exist for non-motorized travel (Figure 1.3-5). Local and state bike plans do not identify any other reasonable east-west bicycle or pedestrian routes in the WIS 23 project corridor, and WIS 23 provides the only east-west route for crossing the Sheboygan River and many other geographical features (kettles). In response to this lack of accommodations, the Fond du Lac County Board passed a resolution supporting a trail connecting the Prairie Trail with the Old Plank Trail in Sheboygan County. The Town of Empire and Sheboygan County also support the trail extension. Support for a trail extension has been received by the WDNR, local municipalities, and the County. Fond du Lac and Sheboygan County have signed bicycle/pedestrian agreements for cost share and maintenance of a future trail connection.



FEIS Figure 1.3-5 Bicycle and Pedestrian Trails

Purpose and need screening:

All build alternatives have the opportunity to include the extension of the Old Plank Trail from Greenbush to Fond du Lac.

The following question indicates how well an alternative satisfies this component of the project purpose and need.

a) Does the alternative provide accommodations for non-motorized travel?

The No-Build alternative does not provide any non-motorized travel accommodations and therefore does not satisfy this purpose and need criterion.

The Passing Lane Without Left-Turn Lanes alternative satisfies this purpose and need criterion. It would include an 8- to 10-foot paved shoulder, which is a bicycle accommodation. The alternative could also include the extension of the Old Plank Trail if additional right of way is purchased. If constructed, the trail would either be built in its ultimate location (based on future 4-lane design) or would be relocated if future 4-lane expansion occurs. At County UU the trail would cross WIS 23 with an at-grade intersection when switching from the south side to the north side. A County UU interchange, which would allow a grade-separated crossing of WIS 23, is not part of this alternative.

The Passing Lane With Left-Turn Lanes alternative satisfies this purpose and need criterion. It also would include an 8- to 10-foot paved shoulder, which is a bicycle accommodation. As with the previous alternative, it could also include an extension of the Old Plank Trail if additional right of way is purchased. The trail would either be built in its ultimate location (based on future 4-lane design) or would be relocated if future 4-lane expansion occurs. At County UU the trail would cross WIS 23 with an at-grade intersection where it switches from the south side to the north side of WIS 23. A County UU interchange, which would allow a grade-separated crossing of WIS 23, is not part of this alternative.

The Hybrid 4-Lane to County G, Passing Lane County G to County P alternative satisfies this purpose and need criterion. It would include an 8- to 10-foot paved shoulder which is a bicycle accommodation. It also could include the extension of the Old Plank Trail if additional right of way is purchased from County G to Greenbush. The trail would be built in its ultimate location (based on a future 4-lane design) or would be relocated if future 4-lane expansion occurs. This alternative provides an interchange at County UU, so trail users could use a grade-separated overpass where the trail switches from the south side to the north side of WIS 23.

The 4-Lane Build On-Alignment alternative satisfies this purpose and need criterion. It includes the Old Plank Trail extension and includes a grade-separated crossing at the County UU interchange where the trail switches from the south side of WIS 23 to the north side of WIS 23.

WIS 23 SEIS Alternative Summary Evaluation Matrix 8-7-2012

Purpose and Need Criteria Question/Alternative	No Build	Passing Lane without Left Turn Lanes	Passing Lane with Left Turn Lanes (and Median Refuge)	Hybrid 4-Lane to Cty G Passing Lane Cty G to Cty P	4-Lane Build On-Alignment
Average 2035 AADT UU to G	10,300	10,860	10,860	11,450	11,980
Average 2035 AADT G to P	9,350	9,800	9,800	10,210	11,010
1. System Linkage and Route Importance a. Does the alternative adequately address truck traffic needs resulting from WIS 23's designation as a long truck route? b. Does the alternative provide system continuity?	No There are limited opportunities for passing and few climbing lanes. No The US 151 and WIS 23 Connector from Fond du Lac to Sheboygan is a mixture of 2-lane and 4-lane facility types.	Partially There are more opportunities for passing and the dispersal of platoons. No WIS 23 Connector from Fond du Lac to Sheboygan remains a mixture of 2-lane, passing lane and 4-lane facility types.	Partially There are more opportunities for passing and the dispersal of platoons. No WIS 23 Connector from Fond du Lac to Sheboygan remains a mixture of 2-lane, passing lane and 4-lane facility types.	Partially The 4-lane portion from US 151 to County G keeps platoons from forming. East of County G there are more opportunities for passing yet platoons still form. No WIS 23 Connector from Fond du Lac to Sheboygan remains a mixture of 2-lane, passing lane and 4-lane facility types.	Yes Additional through lanes keep platoons from forming. Yes WIS 23 Connector from Fond du Lac to Sheboygan has a consistent 4-lane facility type from Fond du Lac to Sheboygan.
2. Transportation Demand/ Regional Economic Development a. Does the alternative reduce travel time? b. Does the alternative provide for more predictable travel?	No Average speed at peak hours is 46 mph. No Traffic is impeded by slow moving agricultural, truck, and recreational vehicles.	No Average speed at 2015 peak hours is almost 48 mph with a travel time savings over the No-Build alternative of about 20 seconds. No Passing lanes are available for 4 of the 36 lane miles, requiring vehicles to look for gaps in the opposing travel stream to travel around slow moving vehicles.	No Average speed at 2015 peak hours is 47 mph with a travel time savings over the No-Build alternative of about 10 seconds. No Passing lanes are available for 4 of the 36 lane miles, requiring vehicles to look for gaps in the opposing travel stream to travel around slow moving vehicles.	Partially The 4-lane section provides free flow speeds. The County G to County P section will continue to have average speeds of just over 47 mph during peak periods. Travel times savings over the No-Build alternative during 2015 peak periods is about 3 minutes 40 seconds. Partially For approximately 24 of the 36 lane mile there is opportunity to pass slow moving vehicles	Yes A full 4-lane facility provides free flow speeds throughout the corridor. Travel times savings over the No-Build alternative during 2015 peak periods is about 6 minutes 20 seconds. Yes A 4-lane facility provides the opportunity for high speed traffic to travel around slow moving vehicles.
3. Legislative and Transportation Planning History a. Is the alternative consistent with and/or reflected in local land use and transportation plans? b. Is the alternative consistent with Wisconsin State Statute 84.013(3)(ra)?	No Contradicts MPO long range plans. No Does not add 5 lane miles to WIS 23 corridor.	Partially Improves the mobility of WIS 23, yet does not provide the 4-lane expansion mentioned in the MPO plans. Partially Does not add one or more lanes of highway for at least 5 miles, but does address roadway significance with passing lanes.	Partially Improves the mobility of WIS 23, yet does not provide the 4-lane expansion mentioned in the MPO plans. Partially Does not add one or more lanes of highway for at least 5 miles, but does address roadway significance with passing lanes	Partially Improves the mobility of WIS 23 and provides the 4-lane expansion discussed in the Fond du Lac Area MPO plan. It does not contain the 4-lane expansion discussed in the 2035 update to the Sheboygan Area Plan. Yes More than 5 lane miles are added to WIS 23.	Yes Improvement is consistent with that mentioned in both the Fond du Lac Area MPO and Sheboygan Area MPO plans Yes More than 5 lane miles are added to WIS 23.
4. Existing and Future Traffic Volumes and Resulting Operations a. Does the alternative improve WIS 23 mainline operational efficiency and mobility by meeting LOS requirements of a Corridors 2030 Connector Route? (Goal = LOS C in 2035 or numeric LOS of less than 4.0 in 2035) b. Does the alternative provide a reasonable LOS for vehicles trying to access WIS 23? (WisDOT seeks to provide an LOS D at all intersections. The more highly used intersections of County G, County UU, and County W provide a metric of how well this criterion is satisfied.)	No WIS 23 mainline operates at LOS D before 2035. No The left-turn and through movements at major intersections are, or soon will be, experiencing substantial delays.	No Westbound and eastbound WIS 23 for both segments of the corridor operate at LOS D in 2035. No Multiple side-road movements operate at LOS E or worse in 2035.	No Westbound and eastbound WIS 23 for both segments of the corridor operate at LOS D in 2035. No Multiple side-road movements operate at LOS E or worse in 2035.	Partially County UU to County G operates at LOS A in 2035. Westbound and eastbound WIS 23 from County G to County P (the end with passing lanes) operate at LOS D in 2035. Yes Side road movements will operate at LOS C or better in 2035.	Yes WIS 23 mainline will operate at LOS A in both directions in 2035. Yes Side road movements will operate at LOS C or better in 2035.
5. Highway Geometry a. Does the alternative incorporate the appropriate design criteria for the roadway classification?	No Shoulder widths are substandard	Partially Roadway is reconstructed to standards for Design Class A2, yet cross section is not able to maintain LOS C in 2035.	Partially Roadway is reconstructed to standards for Design Class A2, yet cross section is not able to maintain LOS C in 2035.	Partially Roadway is reconstructed to standards for Design Class A3 (4-lane) and A2 (2-lane) , yet cross section is not able to maintain LOS C in 2035..	Yes Roadway is reconstructed to standards for Design Class A3
6. Access Management a. Does the alternative reduce the number of hazardous movements (left turns or crossing from sideroads) at public access points through the installation of access restrictions or interchanges?	No All existing intersections remain.	No All existing intersections remain except for 5 intersections in the Fond du Lac urban area.	No All existing intersections remain except for 5 intersections in the Fond du Lac urban area. Some intersections are improved with the used of left turn lanes.	Partially All intersections from County K to County G are improved, limited, or removed. From County G to County P all intersections remain.	Yes All intersections except for five low volume intersections are improved, limited, or removed.

Purpose and Need Criteria Question/Alternative	No Build	Passing Lane without Left Turn Lanes	Passing Lane with Left Turn Lanes (and Median Refuge)	Hybrid 4-Lane to Cty G Passing Lane Cty G to Cty P	4-Lane Build On-Alignment
b. Does the alternative reduce the number of private access points through right of way acquisition?	No Private access points remain	Partially Some private access points removed	Partially Some private access points removed	Partially Many private access points removed from County K to County G. Some private access points removed from County G to County P.	Yes Many private access points removed from County K to County P
c. Does the alternative designate and preserve land for future access modifications, such as overpasses and interchanges, through official mapping?	No	Yes	Yes	Yes	Yes
7. Improve Safety a. Does the alternative adequately address WIS 23 mainline safety? b. Does the alternative address intersection safety? (eg the reduction of angle crashes)	No No safety countermeasures are introduced. No No safety countermeasures are introduced.	Partially Countermeasures introduced address only run off and same direction sideswipe type crashes. No No safety countermeasures are introduced for angle crashes.	Partially Countermeasures introduced address run off, rear end, and same direction sideswipe type crashes. Partially A median refuge is provided for vehicles making a left or crossing maneuver from a side road. No other safety countermeasures are introduced for angle crashes.	Yes From County K to Conty G countermeasures introduced address all major type of crashes (head on, sideswipe opposite direction, same direction sideswipe, rear end, and run off). From County G to County P, countermeasures introduced address only run off and same direction sideswipe type crashes Partially This alternative provides countermeasures that include removing street access, interchange or J-turn construction, and the provision of a median refuge for intersections from USH 151 to County G	Yes Countermeasures introduced address all major type of crashes (head on, sideswipe opposite direction, same direction sideswipe, rear end, and run off). Yes This alternative provides countermeasures that include removing side road access, interchange or J-turn construction, and the provision of a median refuge for intersections throughout the corridor.
8. Accommodations for Non-motorized Travel a. Does the alternative provide accommodations for non-motorized travel?	No No additional accommodations are provided for non-motorized users.	Yes Paved shoulders allow cyclist to ride adjacent to traffic. A separate trail could be constructed if additional right of way is purchased.	Yes Paved shoulders allow cyclist to ride adjacent to traffic. A separate trail could be constructed if additional right of way is purchased.	Yes County K to County G has separate trail for non-motorized users. County G to County P has paved shoulders that allow cyclist to ride adjacent to traffic. A separate trail could be constructed if additional right of way is purchased.	Yes Separate trail for non-motorized users is provided.

APPENDIX LS-C
INDIRECT AND CUMULATIVE EFFECTS ANALYSIS

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Indirect and Cumulative Effects Analysis

WIS 23 Supplemental EIS

Updated: February 24, 2014

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Chapter 1: Introduction

Methodology

The methodology used in this report is based on the Wisconsin Department of Transportation's Guidance for *Conducting an Indirect Effects Analysis* (November 2007) and *Guidance for Conducting a Cumulative Effects Analysis* (November 2007). The guidance for indirect effects was based on a variety of resources and references including NCHRP Report 466, 2002 and *Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process*, FHWA, January 2003. The cumulative effects guidance was based on the CEQ "Eleven Step" process that is described in *Considering Cumulative Effects Under the National Environmental Policy Act (NEPA)*, Council on Environmental Quality, January 1997.

The study team gained substantial knowledge of natural, cultural and historic resources, key demographic and development trends, and local comprehensive plans and development regulations in the ICE study area through compiling the ICE Study Background Report. To provide more detailed local knowledge, the study team engaged the participation of an expert panel comprised of planning, development and conservation officials active in the ICE study area. The expert panel members were asked to complete a lengthy questionnaire about potential indirect and cumulative effects of the WIS 23 No-Build and Build Alternatives, including mapping the locations of identified impacts. Following the compilation of questionnaire and mapping results, the study team held a 2.5 hour workshop with expert panel members to confirm points of consensus and disagreement about potential impacts. During the course of the workshop, many contending opinions were discussed in detail, additional information and insights came to the fore, and a very high degree of consensus emerged.

In addition to compiling the ICE Study Background Report, and reviewing the results of the Expert Panel Questionnaire and Workshop, the ICE study team also drew on substantial internal professional planning, zoning and development expertise. Specifically, the study team consisted of Michael Slavney, FAICP, with 30 years of professional experience for over 30 local governments and Jessica Schmiedicke, AICP, with 7 years of professional experience, and Tom Lynch, PE, with 24 years of professional experience. Mr. Slavney and Ms. Schmiedicke designed the expert panel Questionnaire and accompanying Impact Maps, compiled expert panel input, and facilitated the Expert Panel Workshop to discuss and confirm points of consensus and disagreement. Following the Workshop, the study team combined the local and professional knowledge of the expert panel, with their professional knowledge to write the ICE Report.

Indirect Effects Methodology

The WisDOT six-step method for analyzing a transportation project's potential indirect effects was used to conduct the WIS 23 indirect impacts analysis.

1. Scope, select the tools/activities, and determine the study area.
In selecting tools, the study team referenced Appendix B in WisDOT's Guidance for Conducting an Indirect Effects Analysis. Of the various methods referred to in this document, trend analysis, expert panels, and the Delphi method¹ were most appropriate because these methods leveraged the use of existing information and knowledge. Local land use staff and community officials have the greatest insight into local development trends and have the greatest awareness of potential development proposals.

¹ The Delphi method is a structured communication technique that relies on a panel of experts. Typically a panel of experts answer questionnaires. After the questionnaires are completed, a facilitator provides an anonymous summary of the findings and reasons for them. In a meeting, or otherwise, experts are encouraged to revise their earlier answers in light of the replies of other members of their panel.

2. Inventory the study area and notable features.
See Chapter 2: Inventory of the Study Area.
3. Identify the impact causing activities of the proposed project alternatives.

The No-Build Alternative does not provide access management features, does not provide travel time improvements, and does not include trail enhancements. The No-Build Alternative will have no impacts since it serves as the baseline condition.

The Preferred Build Alternative would expand WIS 23 to 4 lanes and construct interchanges and J-turns at high use intersections. It also extends the Old Plank Road Trail to Fond du Lac and installs a grade-separated crossing for the Ice Age Trail and State Equestrian Trail. The net benefits include improved travel time, increased safety, and better trail facilities along and across WIS 23. The possible disadvantages include the purchase of about 424 acres of new right of way consisting of cropland, uplands, and wetlands. Disadvantages also include the relocation of 51 residences, 10 businesses, and 19 farms.

The benefits of the Preferred Build Alternative could also enable effects that are indirectly associated with the project. Improved travel times could, over time, cause people to make location choices that increase the pace of development along the corridor. Access management features could affect the location of new development, particularly commercial development. The indirect effects of changes to development pace and location would create impacts to the natural environment.

The improved travel times, mobility, and safety would also increase daily travel volumes in the corridor. Figure 0 illustrates the difference in 2035 traffic volumes the corridor would experience between the No-Build and Preferred Build Alternatives².

² Forecast volumes were updated in July 2012 by WisDOT's Traffic Forecasting Section in Madison using both a newly developed travel demand model (TDM) for the Northeast Region, and other post processing measures that use traffic counts. See Section 1.3 of the LS SDEIS.

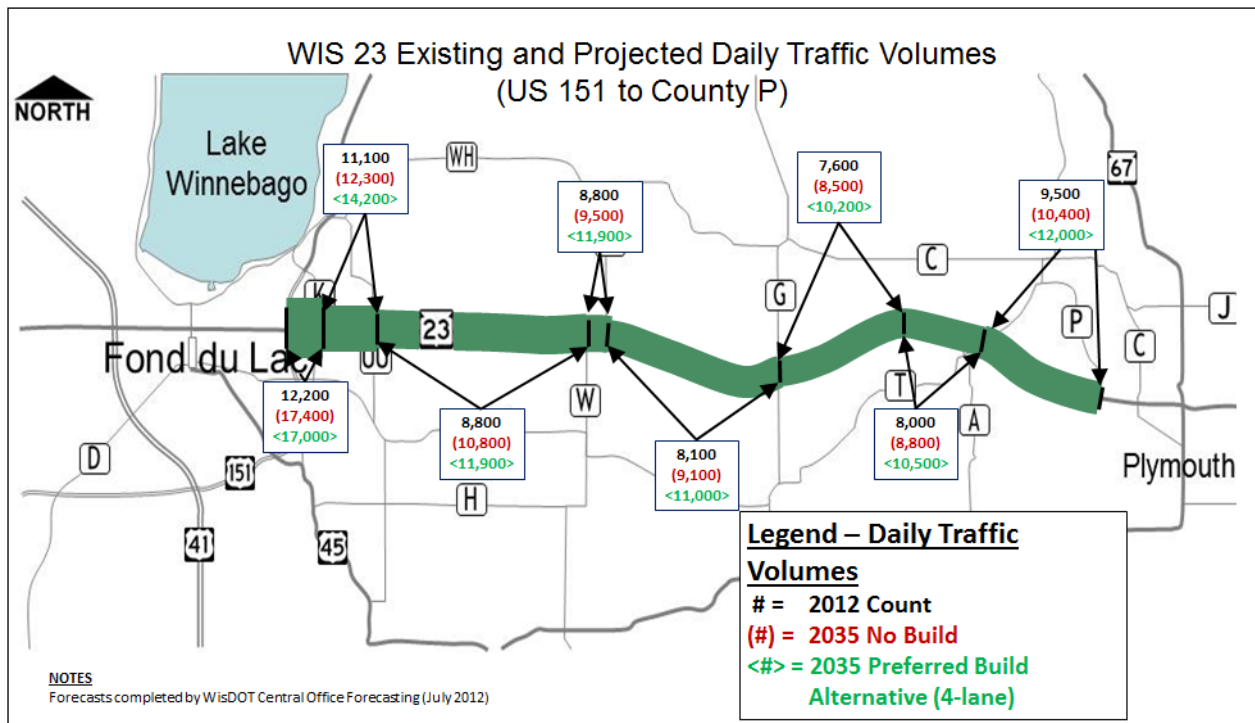


Figure 0: Projected 2035 Traffic Volume Forecasts

4. Identify the potentially significant indirect effects.
See Chapter 3: Indirect Effects Analysis.
5. Analyze the indirect effects and evaluate assumptions.
See Chapter 3: Indirect Effects Analysis.
6. Assess consequences and identify mitigation activities.
See Chapter 5: Activities to Avoid, Minimize, or Mitigate Effects.

Cumulative Effects Methodology

The Council on Environmental Quality's "Eleven-Step" Process was used to conduct the WIS 23 cumulative impacts analysis.

SCOPING FOR THE CUMULATIVE EFFECTS ANALYSIS

1. Identify the significant issues associated with the proposed action and define the assessment.
See Chapter 2: Inventory of the Study Area.
2. Establish geographic scope for the analysis.
See Project Location and Study Area section below.
3. Establish timeframe for analysis (into future).
The timeframe for this cumulative effects analysis is 20 years which corresponds with the planning horizon of the majority of local comprehensive plans; however, it can be assumed that the effects identified in this analysis would continue to be valid after 20 years if local policies and regulations remain the same.
4. Identify other actions affecting the natural, historic, cultural resources, ecosystems and human communities of concern.

See Chapter 4: Cumulative Effects Analysis.

DESCRIBING THE AFFECTED ENVIRONMENT

5. Characterize resources identified in scoping in terms of their response to change and capacity to withstand stress.
See Chapter 4: Cumulative Effects Analysis.
6. Characterize the stresses affecting these resources and their relation to regulatory thresholds.
See Chapter 4: Cumulative Effects Analysis.
7. Define a baseline condition for the resources.
See Chapter 2 Inventory of the Study Area.

DETERMINING THE ENVIRONMENTAL CONSEQUENCES

8. Identify the important cause and effect relationships between human activities including the proposed project and resources.
See Chapter 4: Cumulative Effects Analysis.
9. Determine the magnitude and significance of cumulative effects to those resources identified in the analysis.
See Chapter 4: Cumulative Effects Analysis.
10. Modify or add alternatives to avoid, minimize, or mitigate significant cumulative effects.
See Chapter 5: Activities to Avoid, Minimize or Mitigate Effects.
11. Monitor the cumulative effects of the selected alternative and adapt management.
See Chapter 5: Activities to Avoid, Minimize or Mitigate Effects.

The ICE study team solicited opinions on potential indirect and cumulative impacts of project alternatives from local experts using the Delphi method. Experts were selected based on their professional areas of expertise and their local knowledge of the project study area. The expert panel members included local and regional land use and transportation planners, economic development professionals, and agricultural, natural, and cultural resource experts. The inventory report was provided to panel members to provide an overview of the project and proposed alternatives as well as existing conditions and policies of state and local government. Panel members were asked to review the inventory report, respond to an online survey, and complete a mapping exercise identifying potential indirect and cumulative effects for each of the WIS 23 alternatives. Panelists were also asked to attend a facilitated panel discussion where panelists shared their survey and map responses. The discussion format enabled the identification of points of consensus and disagreement on possible impacts.

Representatives from the following agencies and communities participated:

- Town of Plymouth
- Town of Greenbush
- Town of Forest
- Town of Marshfield
- Town of Taycheedah
- Village of St. Cloud
- Village of Mt Calvary

- Village of Glenbeulah
- City of Plymouth
- City of Fond du Lac
- Sheboygan County Planning Department
- Fond du Lac County Planning Department
- Fond du Lac Metropolitan Planning Organization
- East Central Wisconsin Regional Planning Commission
- Bay-Lake Wisconsin Regional Planning Commission
- WisDNR Wildlife Management, Eastern Fond du Lac and Sheboygan Counties
- Wisconsin Department of Agriculture, Trade, and Consumer Protection
- University of Wisconsin-Extension, Sheboygan County
- University of Wisconsin-Extension, Fond du Lac County
- Wade House Historic Site-Wisconsin Historical Society
- Glacial Lakes Conservancy
- Niagara Escarpment Resource Network

Expert panel responses to the online survey and mapping exercise were tabulated and summarized; the findings of which were used to inform the indirect and cumulative effects analysis sections of this document. Appendix B includes a summary of all survey responses.

Project Location and Study Area

WIS 23 is a connector route in the WisDOT Corridors 2030 state highway plan, is a major east-west highway connecting US 41 and I-43 between the Fox Cities and Milwaukee, and provides a direct route between Fond du Lac and Sheboygan.

This WIS 23 project extends from County K on the east side of the city of Fond du Lac, about one-half mile east of the new US 151/WIS 23 interchange, easterly approximately 19 miles to County P on the west side of the city of Plymouth. The ICE study area for indirect and cumulative impacts is depicted on Map 1. The study area is defined by commutershed and civil boundaries. Land use planners on the study team interacted with staff planners and resource experts from Fond du Lac County, Sheboygan County, and East Central Wisconsin Planning Commission to determine the likely range of influence from the WIS 23 corridor. These land use and resource experts and others were part of the WIS 23 expert panel (see section b. above) and had the opportunity to comment on the study area boundaries in the Expert Panel Survey and on accompanying maps depicting the boundary. Additionally, expert panelists had the opportunity to discuss study area boundaries with the study team in the Expert Panel Meeting held on January 17, 2012 where it was confirmed that the study area boundary was appropriate.

Beyond the study area, the influence of WIS 23 diminishes as other arterial corridors provide access to adjacent lands. It includes the following jurisdictions: city of Fond du Lac, village of Mt. Calvary, village of St. Cloud, town of Empire, town of Forest, town of Taycheedah, and town of Marshfield in Fond du Lac County and the city of Plymouth, village of Glenbeulah, town of Greenbush, and town of Plymouth in Sheboygan County.

Delineation of the ICE study area boundary was influenced by the location of other available parallel corridors that more provide logical alternate routes for WIS 23. On the south side of WIS 23, the presence of US 45, which runs to the southeast from the western end of the WIS 23 corridor, and WIS 67, which runs east and west at the eastern end of the WIS 23 corridor, and County Highway B, which connects US 45 and WIS 67 just south of town boundaries, are the next southerly route options. There are also a series of east/west County highways that provide additional parallel route options. Proximity of these routes and town boundaries informed the decision on where the southerly study area boundary was placed.

On the north side of WIS 23, the presence of WIS 149 running east in the town of Taycheedah provides an appropriate alternate route and a logical northern boundary at the west end of the study area. At the point where 149 heads to the northeast in the town of Marshfield, town boundaries connected by County Highway A provide a logical continuation of the study area boundary to the east.

In addition to these alternate parallel routes, the selection of the study area was also influenced by the location of municipal boundaries. The census collects socioeconomic and housing data by census blocks and tracts, which commonly follow municipal boundaries. Therefore, municipal boundaries were also used to delineate the WIS 23 study area for the ease of analysis of the socioeconomic impacts of the project alternatives.

The 2010 census provided the data for mapping the location of environmental justice populations in municipalities surrounding the WIS 23 corridor and those maps illustrate the following information:

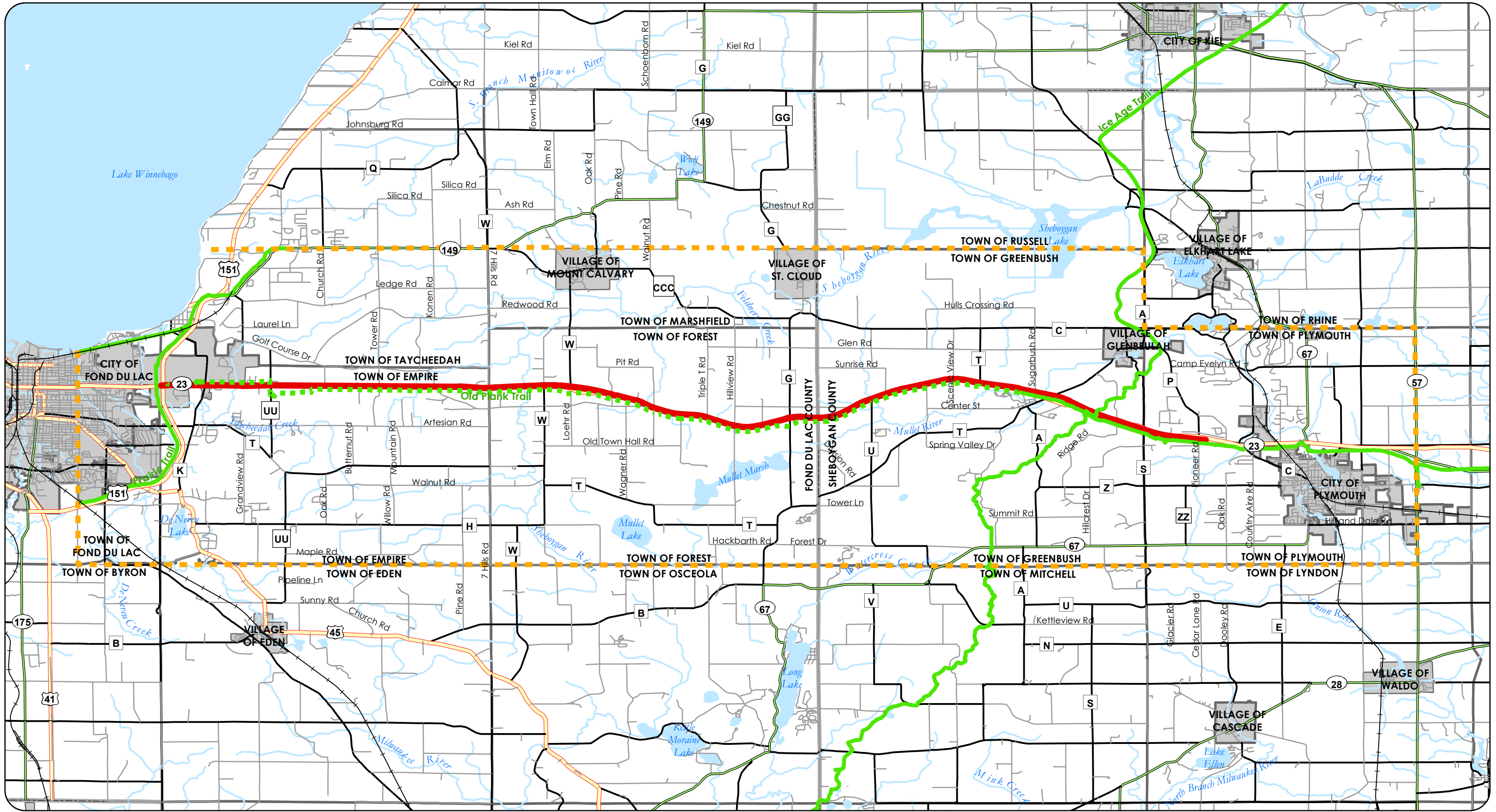
- Map 2: Minority populations are primarily concentrated at the west end of the study area, in the City of Fond du Lac, and west of the WIS 23 proposed improvements, and will not be impacted. The higher-than-average population of minorities in the census tract directly to the east of the city of Fond du Lac is primarily due to the presence of Taycheedah Correctional Institution. This population will not be significantly impacted by WIS 23 improvements.
- Map 3: Hispanic and Latino populations are concentrated at the west end of the study area in the City of Fond du Lac and west of the WIS 23 proposed improvements and will not be significantly impacted.
- Map 4: Concentrations of individuals below the poverty level are concentrated at both ends of the study area in the cities of Fond du Lac and Plymouth. This population is

concentrated beyond the WIS 23 proposed improvements and will not be significantly impacted.

Map 5: Elderly populations are concentrated throughout most of the study area and are likely to be mildly impacted by changes to access on WIS 23. However, the study team determined that elderly populations, like the general population, will benefit from the increased safety measures in the corridor.

Given the general acceptance of the study area boundaries by the expert panel, the location of parallel and alternate routes, and the low impact of WIS 23 proposed improvements on environmental justice populations, the study team determined that the study area boundaries were logical and appropriate.

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WIS 23 **Supplemental EIS** Map 1: Study Area

Sources: Fond du Lac County, Sheboygan County, WIDNR, WisDOT,
 US Census Bureau, Strand Associates, Vandewalle & Associates

0 0.5 1 2 Miles

4/1/2013



Draft: February 24, 2014

- WIS 23
- WIS 23 ICE Study Area

- US Highway
- State Highway
- County Highway
- Railroad

- Existing Trail
- Proposed Trail

- County Boundary
- City or Village Boundary
- Town Boundary
- Surface Water

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CHAPTER 2: INVENTORY OF THE STUDY AREA

The project team gathered data on existing characteristics and current trends in the study area. This information was provided to the expert panel.

Local and Regional Trend Data

Figure 1 on the next page displays population trends and projections for study area communities as well as for Fond du Lac and Sheboygan counties as a whole. As indicated below, population changes have varied greatly. Between 2010 and 2013 population stabilized in most municipalities in the study area, with the exception of the Town of Fond du Lac which grew by an estimated 12 percent, the Sheboygan county portion of the study area which grew by an estimated seven percent, and the Village of Mount Calvary which lost an estimated 25 percent of its population.

Figure 2 on page 11 displays Wisconsin Department of Administration, 2013 Estimates for population projections for the study area communities through 2040. In general, communities throughout the study area are projected to grow. The towns of Fond du Lac and Taycheedah are projected to have the largest percent increases in population, while the villages of Mount Calvary and Saint Cloud are expected to lose population.

Figure 1: Population Trends

	1990	2000	2010	# Change 2000- 2010	% Change 2000- 2010	2013 Estimate*	# Change 2010- 2013	% Change 2010- 2013
Town of Fond du Lac	2,308	2,027	3,015	988	48.7%	3,381	366	12.1%
Town of Empire	2,485	2,620	2,797	177	6.8%	2,808	11	0.4%
Town of Taycheedah	3,383	3,666	4,205	539	14.7%	4,275	70	1.7%
Town of Forest	1,094	1,108	1,080	-28	-2.5%	1,061	-19	-1.8%
Town of Marshfield	1,130	1,118	1,138	20	1.8%	1,135	-3	-0.3%
Village of Mt. Calvary	558	956	762	-194	-20.3%	570	-192	-25.2%
Village of St. Cloud	594	497	477	-20	-4.0%	469	-8	-1.7%
City of Fond du Lac	37,757	42,203	43,021	818	1.9%	43,100	79	0.2%
Fond du Lac County Portion of Study Area Total	49,309	54,195	56,495	2,300	4.2%	56,799	304	0.5%
Town of Greenbush*	1,943	2,773	2,565	-208	-7.5%	2,560	-5	-0.2%
Town of Plymouth	2,911	3,115	3,195	80	2.6%	3,197	2	0.1%
Village of Glenbeulah	386	378	463	85	22.5%	460	-3	-0.6%
City of Plymouth	6,769	7,781	8,445	664	8.5%	8,416	-29	-0.3%
Sheboygan County Portion of Study Area Total	12,009	14,047	13,637	-410	-2.9%	14,633	996	7.3%
Study Area Total	61,318	68,242	70,132	1,890	2.8%	71,432	1,300	1.9%
Fond du Lac County	90,083	97,296	101,633	4,337	4.5%	101,984	351	0.3%
Sheboygan County	103,877	112,646	115,507	2,861	2.5%	115,386	-121	-0.1%
Wisconsin	4,891,769	5,363,675	5,686,986	323,311	6.0%	5,717,110	30,124	0.5%

Source: US Census Bureau, 1990, 2000, 2010 Population of the Census,

Wisconsin Department of Administration 2013 Estimates

*Note: Town of Greenbush 2010 population revised by Census Bureau on May 29, 2012 from 1,534 to 2,565.

Figure 2: Population Projections (2010-2040)

	2010	2015	2020	2025	2030	2035	2040	# Change 2010-2040	% Change 2010-2040
Town of Fond du Lac	3,015	2,542	2,603	2,657	2,697	4,345	4,455	1,440	47.76%
Town of Empire	2,797	2,971	3,081	3,181	3,265	3,135	3,130	333	11.91%
Town of Taycheedah	4,205	4,258	4,446	4,622	4,773	5,220	5,305	1,100	26.16%
Town of Forest	1,080	1,166	1,186	1,201	1,211	990	950	-130	-12.04%
Town of Marshfield	1,138	1,136	1,140	1,140	1,133	1,160	1,140	2	0.18%
Village of Mt. Calvary	762	1,066	1,128	1,186	1,237	520	495	-267	-35.04%
Village of St. Cloud	477	517	520	523	523	430	410	-67	-14.05%
City of Fond du Lac	43,021	46,072	47,664	49,118	50,312	46,370	45,920	2,899	6.74%
Fond du Lac County Portion of Study Area	56,495	59,728	61,768	63,628	65,151	62,170	61,805	5,310	9.40%
Town of Greenbush	2,565	2,903	3,063	3,216	3,355	2,695	2,630	65	2.5%
Town of Plymouth	3,195	3,526	3,647	3,760	3,857	3,590	3,560	365	11.42%
Village of Glenbeulah	463	449	467	484	499	555	560	97	20.95%
City of Plymouth	8,445	9,197	9,726	10,233	10,696	9,800	9,785	1,340	15.87%
Sheboygan County Portion of Study Area	13,637	16,075	16,903	17,693	18,407	16,640	16,535	2,898	21.25%
Study Area Total	70,132	75,803	78,671	81,321	83,558	78,810	78,340	7,177	10.09%
Fond du Lac County	101,633	106,183	109,391	112,268	114,557	111,040	110,250	7,365	7.2%
Sheboygan County	115,507	123,209	127,195	130,875	133,979	126,830	125,160	9,245	8.0%
Wisconsin	5,686,986	5,988,420	6,202,810	6,390,900	6,541,180	6,476,270	6,491,635	804,649	14.15%

Source: Wisconsin Department of Administration, 2015-2040 Population Projections, 2013.

Figure 3 shows household projections for study area communities and counties. As indicated below, the study area is expected to see increases in the number of households, primarily in the city of Fond du Lac. The villages of Mt. Calvary, St. Cloud, and Glenbeulah and the towns of Marshfield and Forest are projected to only see modest increases in the number of households by 2030.

Figure 3: Household Projections (2010-2030)

	2010	2015	2020	2025	2030	# Change 2015-2030	% Change 2015-2030
Town of Fond du Lac	1,014	1,055	1,092	1,122	1,144	130	12.8%
Town of Empire	1,045	1,100	1,153	1,198	1,236	191	18.3%
Town of Taycheedah	1,539	1,634	1,724	1,803	1,872	333	21.6%
Town of Forest	432	445	458	467	473	41	9.5%
Town of Marshfield	397	405	410	413	413	16	4.0%
Village of Mt. Calvary	225	242	259	274	288	63	28.0%
Village of St. Cloud	199	204	207	210	211	12	6.0%
City of Fond du Lac	18,398	19,332	20,199	20,946	21,569	3,171	17.2%
Fond du Lac County Portion of Study Area	23,249	24,417	25,502	26,433	27,206	3,957	17.0%
Town of Greenbush	576	616	654	691	727	151	26.2%
Town of Plymouth	1,208	1,263	1,316	1,368	1,413	205	17.0%
Village of Glenbeulah	179	188	198	207	214	35	19.6%
City of Plymouth	3,744	4,008	4,270	4,527	4,767	1,023	27.3%
Sheboygan County Portion of Study Area	5,707	6,075	6,438	6,793	7,121	1,414	24.8%
Study Area Total	28,956	30,492	31,940	33,226	34,327	5,371	18.5%
Fond du Lac County	41,036	42,933	44,692	46,164	47,362	6,326	15.4%
Sheboygan County	47,310	49,304	51,241	53,092	54,718	7,408	15.7%

Source: Wisconsin Department of Administration, 2015-2030 Housing Projections, 2008.

Figure 4 lists 2010 housing characteristics in the study area including average household size, number of housing units and vacancy rates for the year, and median home value estimates. In terms of home values, housing is considerably more affordable in the city of Fond du Lac and villages of St. Cloud and Glenbeulah compared to other communities in the study area. Home values in the towns of Taycheedah, Plymouth, Empire, and Fond du Lac are the highest among study area communities and respective counties.

Figure 4: Housing Characteristics 2010

	Average Household Size	Total Housing Units	Occupied Housing Units	Home Owner Vacancy Rate	Median Value Owner Occupied Housing
Town of Fond du Lac	2.58	1,239	1,167	2.50%	\$218,200
Town of Empire	2.64	991	957	0.00%	\$227,600
Town of Taycheedah	2.62	1,755	1,602	1.60%	\$228,800
Town of Forest	2.67	436	404	1.60%	\$174,000
Town of Marshfield	2.51	497	422	1.10%	\$176,500
Village of Mt. Calvary	2.59	197	183	0.00%	\$136,400
Village of St. Cloud	2.29	216	208	2.70%	\$129,500
City of Fond du Lac	2.28	19,181	17,942	2.40%	\$122,900
Town of Greenbush	2.7	594	568	1.50%	\$196,000
Town of Plymouth	2.64	1,229	1,152	1.40%	\$211,600
Village of Glenbeulah	2.39	204	194	3.00%	\$131,300
City of Plymouth	2.26	4,039	3,710	2.30%	\$149,700
Fond du Lac County	2.41	43,451	40,484	1.10%	\$143,000
Sheboygan County	2.42	50,766	46,390	2.20%	\$151,100

Source: U.S. Census 2010

Income and Employment Characteristics

Figure 5 shows income and employment information in the study area. Median household income ranged from approximately \$43,400 to over \$85,000. The town of Empire had the highest median household income compared to other study area communities; the cities of Fond du Lac and Plymouth had the lowest. The percentage of families below the poverty level was highest in the cities of Fond du Lac and Plymouth. Communities with low percentages of families in poverty include the towns of Fond du Lac and Forest. The town of Plymouth and the villages of Glenbeulah and Mount Calvary have no families in poverty. The percentage of the population in the labor force for each community is also depicted in Figure 5. Study area communities were generally comparable to or above the overall percentage for Fond du Lac and Sheboygan counties, with the town of Empire and village of Glenbeulah having the highest percentage of population in the labor force compared to other study area communities. The Village of Mount Calvary and the Town of Greenbush had the lowest percentage of population in the labor force at 58.2 percent and 39.2 percent respectively.

Figure 5: Income and Employment

	Median Household Income	Percent of Families below Poverty Level	% Population in Labor Force
Fond du Lac County	\$52,717	6.6%	70.1%
Town of Fond du Lac	\$77,969	0.8%	70.0%
Town of Empire	\$85,647	1.8%	76.5%
Town of Taycheedah	\$71,822	4.5%	65.4%
Town of Forest	\$65,139	0.9%	75.9%
Town of Marshfield	\$73,250	3.1%	73.4%
Village of Mt. Calvary	\$50,313	0.0%	58.2%
Village of St. Cloud	\$61,250	3.4%	73.5%
City of Fond du Lac	\$43,457	10.0%	68.4%
Sheboygan County	\$52,993	5.6%	69.3%
Town of Greenbush	\$69,063	5.3%	39.2%
Town of Plymouth	\$82,174	0.0%	70.4%
Village of Glenbeulah	\$54,861	0.0%	76.6%
City of Plymouth	\$47,097	11.1%	68.2%

Sources: American Community Survey, 2007-2011

Commuting Patterns

United States Census Bureau “place of work” data provides an indication of how the WIS 23 corridor is used for worker commuting. Figures 6 through 9 list the volume of commutes between counties based on the American Community Survey (ACS) 5-Year Estimates, 2006-2010 (the 2010 Census did not collect commuting data).

The 2006-2010 ACS also provides the total number of work destination commutes by county. For Fond du Lac County residents, the average number of commutes per year was 52,124. Figure 6 shows that of those, 36,545 commutes (70 percent) were to work destinations that remained in Fond du Lac County Figure 6 also shows that Dodge County was the top workplace destination for Fond du Lac County residents who work outside of their county of residence (8.68%).

Figure 6: Top Workplace Destinations for Fond du Lac County Residents

Average 2006-2010

Top Workplace Destinations for Fond du Lac County Residents	Number of Commutes by Fond du Lac County Residents	Percentage of Commutes by Fond du Lac County Residents
Fond du Lac County	36,545	70.11%
Dodge County	4,526	8.68%
Winnebago County	3,348	6.42%
Washington County	2,180	4.18%
Sheboygan County	1,042	2.00%
Green Lake County	781	1.50%

Source: US Census, American Community Survey 5-year Estimates (2006-2010)

The total number of commutes to Fond du Lac county from all counties (including counties not listed in Figure 7, below) is 47,343. Figure 7 shows that the majority of those commuting to workplace destinations in Fond du Lac County but residing outside of Fond du Lac County, live in Winnebago County (5.8%).

Figure 7: Top Counties of Residence for Fond du Lac County Workers**Average 2006-2010**

Top Counties of Residence for Fond du Lac County Workers	Number of Commutes to Fond du Lac County	Percentage of Total Commutes to Fond du Lac County
Fond du Lac County	36,545	77.2%
Winnebago County	2,759	5.8%
Dodge County	2,063	4.4%
Green Lake County	1,829	3.9%
Washington County	829	1.8%
Sheboygan County	657	1.4%

Source: US Census, American Community Survey 5-Year Estimates (2006-2010)

For Sheboygan county residents, the average number of commutes per year was 58,503 between 2006 and 2010. Figure 8 shows that a total of 49,742 commutes (85 percent) were to Sheboygan County work destinations. Figure 8 also shows that Ozaukee County was the top workplace destination for Sheboygan County residents who work outside of their county of residence (4.3%).

Figure 8: Top Workplace Destinations for Sheboygan County Residents**Average 2006-2010**

Top Workplace Destinations for Sheboygan County Residents	Number of Commutes by Sheboygan County Residents	Percentage of Commutes by Sheboygan County Residents
Sheboygan County	49,742	85.0%
Ozaukee County	2,495	4.3%
Manitowoc County	1,689	2.9%
Milwaukee County	1,365	2.3%
Washington County	865	1.5%
Fond du Lac County	561	1.0%

Source: US Census, American Community Survey 5-Year Estimates (2006-2010)

The total number of commutes to Sheboygan county from all counties (including counties not listed in Figure 9, below) is 58,400. Figure 9 shows that the majority of those commuting to workplace destinations in Sheboygan County but residing outside of Sheboygan County, live in Manitowoc County (6.3%).

Figure 9: Top Counties of Residence for Sheboygan County Workers

Average 2006-2010

Top Counties of Residence for Sheboygan County Workers	Number of Commutes to Sheboygan County	Percentage of Total Commutes to Sheboygan County
Sheboygan County	49,742	85.2%
Manitowoc County	3,706	6.3%
Fond du Lac County	1,170	2.0%
Ozaukee County	1,042	1.8%
Calumet County	842	1.4%
Milwaukee County	457	0.8%

Source: US Census, American Community Survey 5-Year Estimates (2006-2010)

Environmental Justice Data

ICE Study Area County Race and Ethnicity Data

Figure 10 lists the 2010 Census statistics for race and ethnicity in ICE study area communities. As indicated below, the majority of the population is white in all study area communities. Map 2 depicts census tracts in ICE study area communities where the raw number of and percentage of minority population (non-white) is greater than the county per tract average. As depicted on the map, minority populations are located near the city of Fond du Lac where two tracts have a higher number of minorities than the county average and two tracts have a higher percentage of minority population than the county. Map 3 depicts census tracts in ICE study area communities where the raw number of and percentage of Hispanic or Latino population exceeds the county per tract average. Again, these populations are located in the city of Fond du Lac.

Figure 10: Race and Ethnicity of ICE Study Area Communities

	Race						Ethnicity
	% White	% Black or African American	% American Indian or Alaskan Native	% Asian	% Native Hawaiian or Other Pacific Islander	% Some Other Race	% Hispanic/ Latino
Town of Fond du Lac	97.2	0.3	0.1	1.0	0.0	0.7	2.7
Town of Empire	97.8	0.6	0.1	0.6	0.1	0.2	1.5%
Town of Taycheedah	97.9	0.2	0.2	0.7	0.0	0.2	1.7
Town of Forest	98.4	0.1	0.2	0.2	0.5	0.2	0.9%
Town of Marshfield	98.3	0.2	0.0	0.0	0.0	1.0	1.0
Village of Mt. Calvary	83.6	1.3	1.0	8.3	0.0	5.2	10.9
Village of St. Cloud	96.9	0.0	0.6	0.4	0.0	1.5	2.7
City of Fond du Lac	90.6	2.5	0.7	1.8	0.0	2.5	6.4%
Fond du Lac County	94.1	1.3	0.5	1.1	0.0	1.7	4.3%
Town of Greenbush	97.7	0.0	0.6	0.7	0.0	0.4	1.4%
Town of Plymouth	98.4	0.1	0.1	0.4	0.0	0.3	0.8
Village of Glenbeulah	98.7	0.0	0.2	0.0	0.0	0.4	1.1
City of Plymouth	96.2	0.4	0.4	0.7	0.0	0.9	2.4
Sheboygan County	89.9	1.5	0.4	4.6	0.0	1.6	5.5%

Source: U.S. Census Bureau, 2010.

ICE Study Area County Poverty Rates

Figure 11 lists the percentage of individuals living below the poverty level in study area communities. Map 4 depicts census tracts where the percentage of individuals living below the poverty level is greater than the county average. As depicted on the map, concentrations of populations individuals living below the poverty level are located near the cities of Fond du Lac and Plymouth where two tracts in both cities have a percentage of individuals living below the poverty level that is higher than their respective county.

Figure 11: Poverty Rate in ICE Study Area Communities

	% Individuals Living Below the Poverty Level
Town of Fond du Lac	0.9
Town of Empire	4.1
Town of Taycheedah	5.4
Town of Forest	3.1
Town of Marshfield	4.1
Village of Mt. Calvary	13.1
Village of St. Cloud	6.0
City of Fond du Lac	13.1
Fond du Lac County	9.5
Town of Greenbush	6.0
Town of Plymouth	1.2
Village of Glenbeulah	0.0
City of Plymouth	13.6
Sheboygan County	8.2

Source: U.S. Census Bureau, 2007-2011 American Community Survey.

ICE Study Area County Age Statistics

Figure 12 lists the median age of residents in study area communities as well as the percentages of the population in each county under age 5, under age 18, and over age 65. Map 5 depicts census tracts in study area communities where the raw number of and percentage of elderly (65+) is greater than the county average. As depicted on the map, most census tracts in the study area have a large elderly population with the exceptions of the town of Greenbush and the village of Glenbeulah. The village of Mt. Calvary has a low median age and high percentage of population under age 18 due to the presence of St. Lawrence Seminary High School in addition to the public schools.

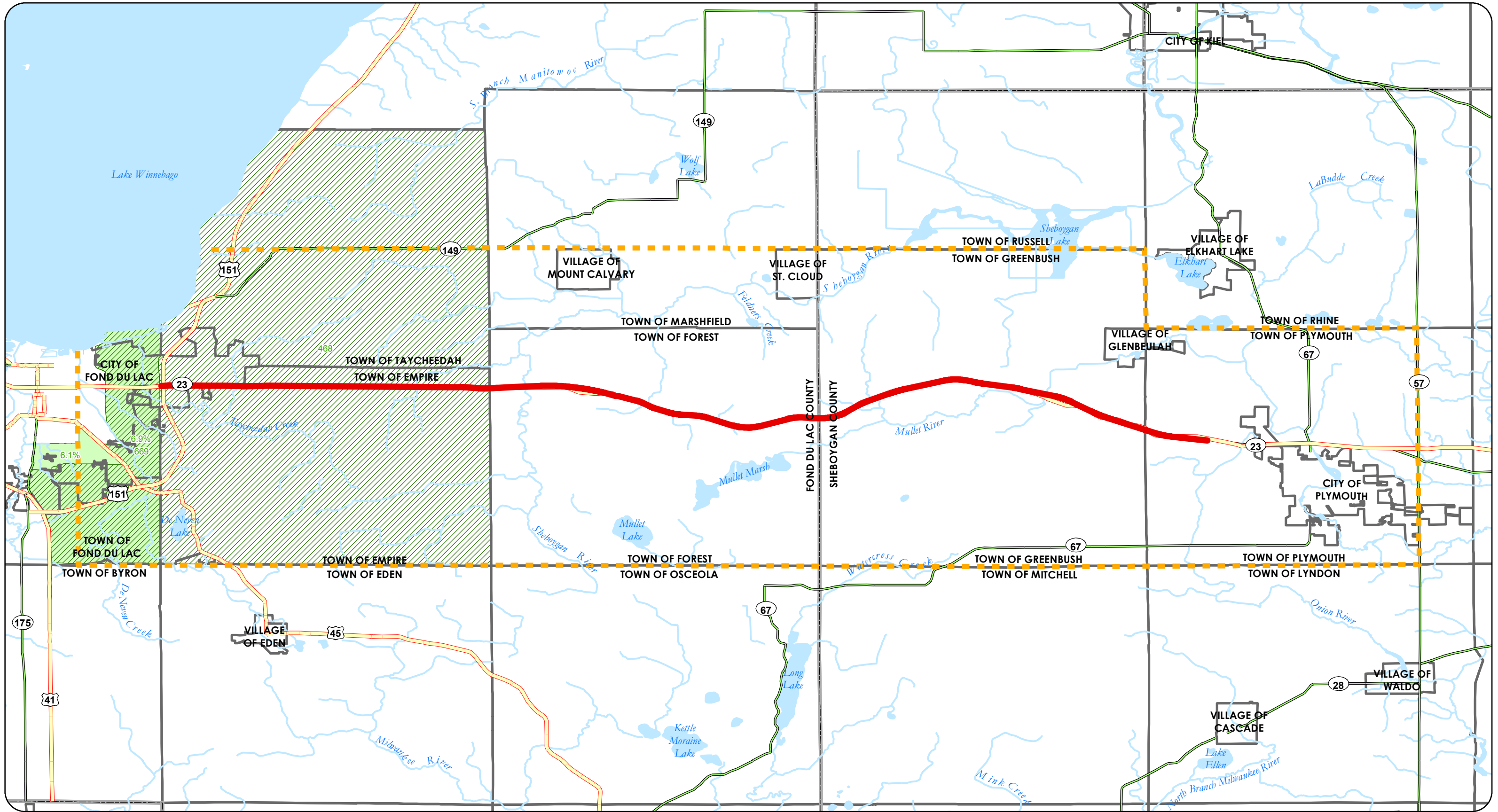
Figure 12: Age in Study Area Counties

	Median Age	% Pop. Under Age 18	% Pop. Age 65 and Over
Town of Fond du Lac	43.6	22.8	15.2
Town of Empire	46.7	22.2	13.6
Town of Taycheedah	45.1	22.6	15.0
Town of Forest	43.4	22.8	13.5
Town of Marshfield	47.5	19.2	21.8
Village of Mt. Calvary	26.8	39.6	16.1
Village of St. Cloud	43.3	20.3	16.4
City of Fond du Lac	36.9	22.6	14.7
Fond du Lac County	40.2	22.7	15.0
T. Greenbush	43.2	25.7	11.5
Town of Plymouth	47.7	22.8	16.1
Village of Glenbeulah	41.4	22.0	12.1
City of Plymouth	43.2	25.7	11.5
Sheboygan County	40.3	23.9	14.6

Source: *U.S. Census 2010*

Study Area Disabled Populations

The study team did not analyze disabled populations in the study area due to lack of available data on such populations. However, these populations tend to be located in the same areas as other EJ populations.



WIS 23 **Supplemental EIS**

Map 2: Minority Population Concentration

Sources: Fond du Lac County, Sheboygan County, WIDNR, WisDOT,
US Census Bureau, Strand Associates, Vandewalle & Associates

0 0.5 1 2 Miles

4/1/2013



— WIS 23

- - - WIS 23 ICE Study Area

County Boundary

Municipal Boundary

Surface Water

Census Tracts with Percentage of Minority
Population Greater than County Percentage*

Census Tracts with Minority Population
Number Greater than County Average**

— US Highway

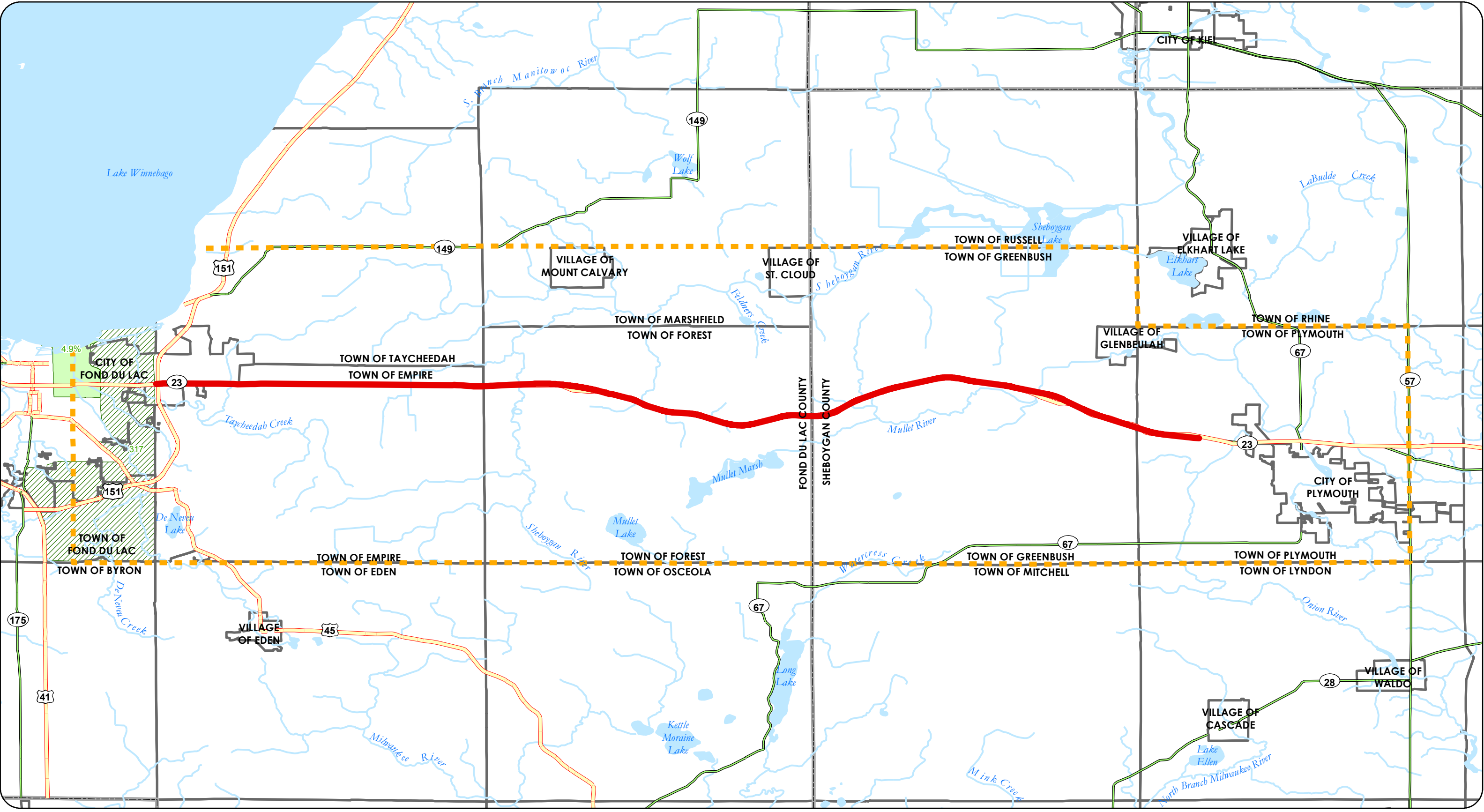
— State Highway

Draft: February 24, 2014

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C-29

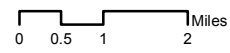
*Overall Percentage of Minorities in Fond du Lac County: 5.9%
*Overall Percentage of Minorities in Sheboygan County: 10.1%

**Average Minority Population Number Per Tract in Fond du Lac County: 298
**Average Minority Population Number Per Tract in Sheboygan County: 448



WIS 23
Supplemental EIS

Map 3: Hispanic or Latino Population Concentration
Sources: Fond du Lac County, Sheboygan County, WIDNR, WisDOT,
US Census Bureau, Strand Associates, Vandewalle & Associates



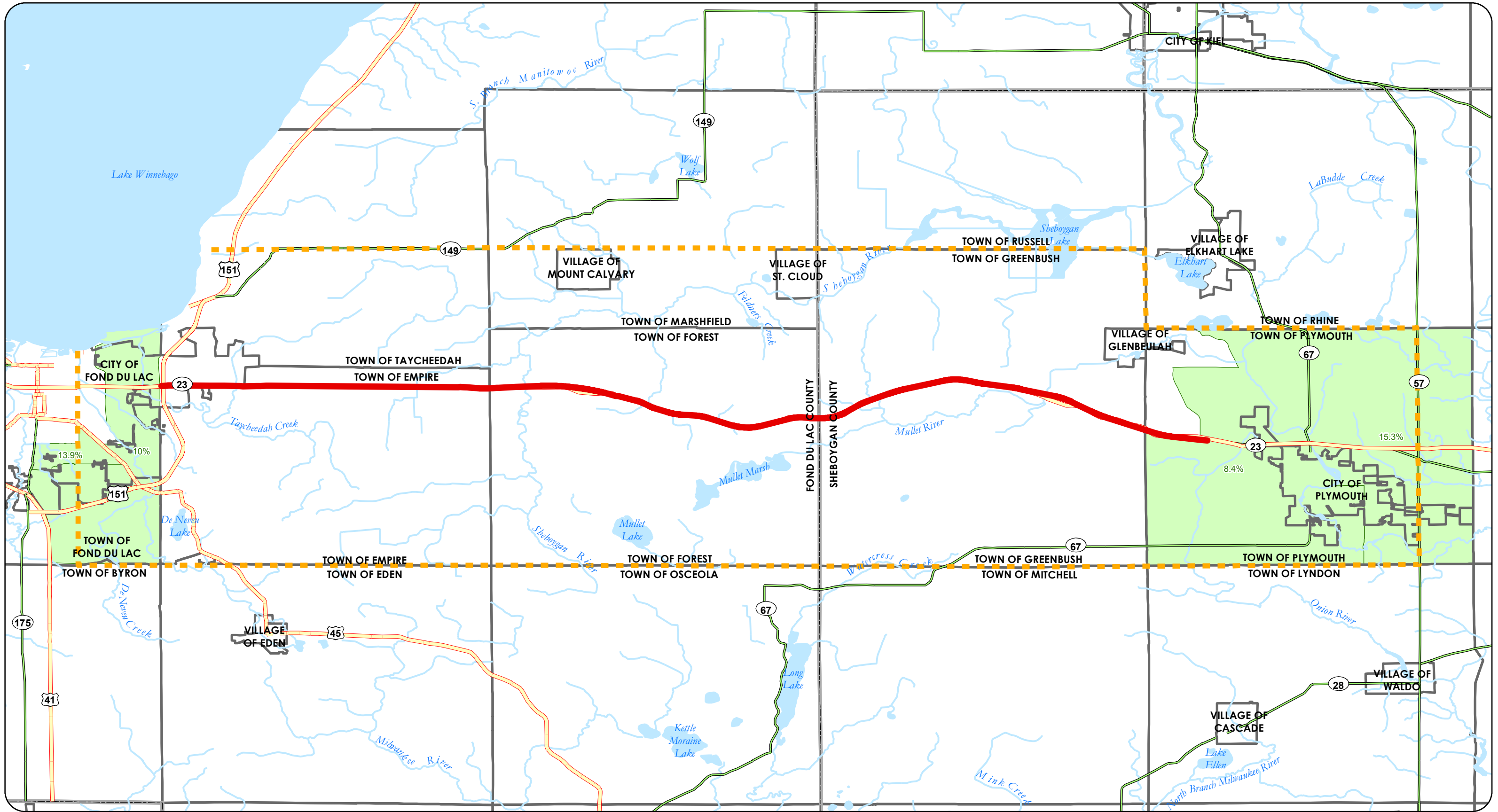
4/1/2013



- WIS 23
- WIS 23 ICE Study Area
- Census Tracts with Percentage of Hispanic/Latino Population Greater than County Percentage*
- Census Tracts with Hispanic/Latino Population Number Greater than County Average**
- County Boundary
- Municipal Boundary
- Surface Water
- US Highway
- State Highway

Draft: February 24, 2014

*Overall Percentage of Hispanic or Latinos in Fond du Lac County: 4.3%
*Overall Percentage of Hispanic or Latinos in Sheboygan County: 5.5%
**Average Hispanic or Latino Population Number Per Tract in Fond du Lac County: 218
**Average Hispanic or Latino Population Number Per Tract in Sheboygan County: 243



**WIS 23
Supplemental EIS**

Map 4: Population Concentration
of Individuals Below Poverty Level
Sources: Fond du Lac County, Sheboygan County, WIDNR, WisDOT,
US Census Bureau, Strand Associates, Vandewalle & Associates

0 0.5 1 2 Miles

4/1/2013



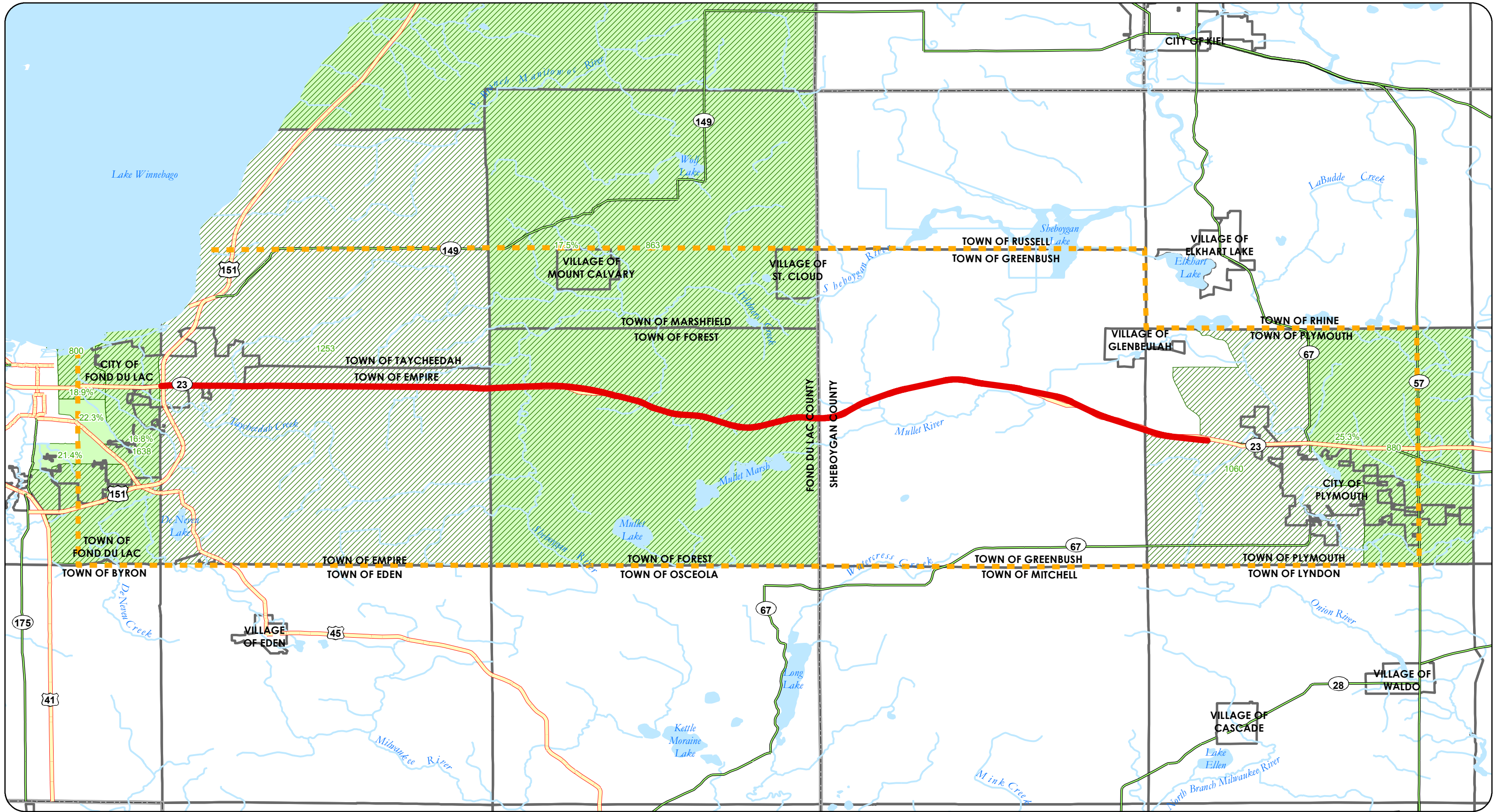
- WIS 23
- - - WIS 23 ICE Study Area
- County Boundary
- Municipal Boundary
- Surface Water

Census Tracts with Percentage of Population
in Poverty Greater than County Percentage*

- US Highway
- State Highway

*Overall Percentage of Population in Poverty in Fond du Lac County: 9.5%
*Overall Percentage of Population in Poverty in Sheboygan County: 8.2%

Draft: February 24, 2014



WIS 23 **Supplemental EIS**

Map 5: Elderly (65+) Population Concentration

Sources: Fond du Lac County, Sheboygan County, WIDNR, WisDOT,
US Census Bureau, Strand Associates, Vandewalle & Associates

0 0.5 1 2 Miles

4/1/2013



— WIS 23

- - - WIS 23 ICE Study Area

County Boundary

Municipal Boundary

Surface Water

Census Tracts with Percentage of Elderly
Population Greater than County Percentage*

Census Tracts with Elderly Population
Number Greater than County Average**

US Highway

State Highway

*Overall Percentage of Elderly Population in Fond du Lac County: 15.0%
*Overall Percentage of Elderly Population in Sheboygan County: 14.6%

**Average Elderly Population Number Per Tract in Fond du Lac County: 761
**Average Elderly Population Number Per Tract in Sheboygan County: 647

Draft: February 24, 2014

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Appendix LS-C

Agricultural Resources

Agricultural activities dominate land use along the rural parts of the study area. This contributes significantly to the study area's economy and character. Farm commodities produced in the study area counties include dairy, winter wheat, corn silage, sweet corn, green peas, soybeans, alfalfa, mushrooms, pork, and beef. Figure 13 lists economic impacts of the agricultural economies of Fond du Lac and Sheboygan Counties.

Figure 13: Impacts of the Agricultural Economy

	Jobs	Business Sales	Income	Taxes paid
Fond du Lac County	8,692	\$2.3 billion	\$576 million	\$52 million
Sheboygan County	8,464	\$3.3 billion	\$629 million	\$49 million

Source: USDA 2007 Census of Agriculture and University of Wisconsin-Extension, Cooperative Extension

Map 6 depicts soil classifications within the study area. The Natural Resources Conservation Service groups soils into classes based on their capability to produce common cultivated crops and pasture plants. These capability classifications are based on numerous criteria that include, but are not limited to, the soil's salinity; capacity to hold moisture; potential for erosion; depth, texture, and structure; and local climatic limitations (e.g., temperature and rainfall). Under this system of classification, soils are separated into eight classes. Generally, Class I and II soils are the best suited for the cultivation of crops. Approximately 53 percent of the lands within the study area are classified as Class I and II soils, the most productive agricultural soil categories.

Natural Resources

Consideration of natural resources and environmentally sensitive areas is essential in local land use decision making. Long-term preservation of natural features is identified as a goal in the comprehensive plans of each of the study area communities as well as preserving the appearance of the landscape. Natural resources in the study area are depicted on Maps 7a and 7b and described below.

Environmental Corridors

Environmental corridors are depicted on Maps 7a, 8, 9a, and 9b. These areas include generally continuous open space systems based on lands that have sensitive natural resources and limitations for development, including WDNR identified wetlands, subject to existing State-mandated zoning, FEMA designated floodplains, and slopes of 12 percent or greater. Environmental corridors have environmental, ecological, passive recreational, stormwater management, groundwater protection and recharge, erosion control, wildlife, timber, and scenic value. Since environmental corridors have severe limitations for development, minimizing development in these areas also protects private property.

Steep Slopes

Steep slopes of greater than 12 percent are depicted on Map 7a. Steep slopes are generally concentrated in the Kettle Moraine State Forest on the eastern side of the study area. There are also scattered areas of steep slopes in the towns of Empire, Taycheedah, Forest, and Marshfield.

Floodplains

Floodplains are depicted on Map 7a as a component of environmental corridors. Flood hazard areas are located along the rivers, creeks, and public natural areas in the study area such as the Sheboygan Marsh and the Mullet Marsh. These have been identified and mapped by the Federal Insurance Administration for risk management purposes. The 100-year flood area, where the flooding probability is greater than 1% in any given year, is generally restricted to no development by state statute-authorized local zoning.

Wetlands

Most wetlands within the study area are located along the rivers, creeks, and public natural areas in the study area such as the Sheboygan Marsh and the Mullet Marsh. There are also isolated wetlands in the north part of the town of Empire and the southern part of the town of Taycheedah. Wetlands have been identified and mapped by the Army Corps of Engineers and the Wisconsin Department of Natural Resources. These areas are important for aquifer recharge, groundwater and surface water quality improvement, and wildlife habitat. Generally, wetlands are restricted to no development by state statute-authorized local zoning. The Sheboygan Marshes are identified as a Land Legacy Place described in the plans and initiatives section of this document.

Glacial Features

More than 10,000 years ago, glaciers, sheets of ice over a mile thick, covered much of the northern United States, including most of Wisconsin and the entire study area. As they were forming, the slow-moving glaciers ground bedrock into fine powder and transformed a rough terrain into rolling plains. In the Kettle Moraine area, these features are found in unusual abundance. The Kettle Moraine is also unusual in that it is an interlobate moraine, formed where two lobes of the continental glacier are flowing close to and roughly parallel to one another. The Kettle Moraine, formed between the Lake Michigan lobe and the Green Bay lobe, is one of the best examples of an interlobate moraine in the world. The following geological formations are the result of the glacier.

- **Drumlin:** Oval teardrop-shaped hills formed under the glacial ice near the advancing front of a glacier.
- **Erratic:** Boulders and large rocks carried by glaciers and deposited on the surface of the land after the ice melted.
- **Esker:** A long, narrow ridge of coarse gravel deposited by a stream flowing in an ice-walled valley or tunnel in a melting glacier.
- **Kame:** A conical-shaped hill of sand and gravel that was formed by glacial meltwater swirling into a vertical shaft in the glacier.
- **Kettle:** A depression formed by the melting of a large block of glacial ice that was partially or completely buried. Some kettles hold water to form kettle lakes.
- **Moraine:** Jumbled hills of unsorted, unstratified glacial debris found at the sides or front of a glacier.

Niagara Escarpment

The Niagara Escarpment is the steep face of a 650-mile bedrock ridge that runs from Rochester, New York, across portions of southeastern Canada, and then southward north and west of Lake Michigan to southeastern Wisconsin. In Wisconsin, the escarpment extends for over 230 miles from Door Peninsula to northern Waukesha and Milwaukee counties. In the study area, the Escarpment runs north to south through the center of Fond du Lac County and is a prominent feature near the southeastern shore of Lake Winnebago.

Conservation Easements

Conservation easements protect land from future development. Fond du Lac County administers the Conservation Reserve Enhancement Program (CREP), which is a voluntary land retirement program that helps protect environmentally sensitive land, decrease erosion, restore wildlife habitat, and safeguard ground and surface water. As of 2009, approximately 1,100 acres of land in Sheboygan County have been protected through acquisition by WDNR or through private donations to the Glacial Lakes Conservancy.

Basins and Watersheds

The Sheboygan River Basin covers the eastern $\frac{3}{4}$ of the study area. The western portion of the study area is located in the Upper Fox River Basin. Watersheds within these basins covering the study area include Lake Winnebago-East, Sheboygan River, Mullet River, and the Onion River watersheds. These areas are described below and depicted on Map 7b.

- The Sheboygan River basin has been identified by the International Joint Commission as a Great Lakes Area of Concern. The lower portion of the basin, east of the study area, is characterized by poor water quality. Identified pollutants are suspended solids, fecal coliform bacteria, phosphorus, nitrogen, PCBs, PAHs, and heavy metals. Contamination is the result of both point and nonpoint sources of pollution, including industrial and municipal wastewater discharge and runoff from agricultural lands, roadways, parking lots, construction sites, and other urban and suburban areas.
- The westernmost portion of the study area is located in the Upper Fox River Basin. Groundwater quality varies throughout the basin. Some natural threats to groundwater quality are hardness, iron, manganese, radium/radon, and arsenic. WDNR identified the following threats in the Fond du Lac County portion of the basin: nutrient (i.e., phosphorus and nitrogen) and sediment loading to surface waters from agricultural and urban sources; groundwater contamination; use of fertilizers and pesticides in urban communities; and wildlife habitat destruction and fragmentation.
- The Lake Winnebago-East watershed is located along the east and south shores of Lake Winnebago in Calumet and Fond du Lac counties. This watershed generally flows east to west and drains into Lake Winnebago and contains Taycheedah Creek. This watershed is dominated by agriculture but does include more than a third of the city of Fond du Lac as well as the rapidly developing area east of Fond du Lac on the west slope of the Niagara Escarpment. This watershed is ranked high for nonpoint source issues affecting streams and groundwater. Agricultural nutrient and soil erosion runoff have been dominant pollutants, but nonpoint urban runoff is an increasing concern.
- The Sheboygan River watershed is the largest and possibly the most diverse watershed in the Sheboygan River basin. The Sheboygan River originates in east-central Fond du Lac County and flows generally southeastward into the city of Sheboygan where it enters Lake Michigan. Water quality is good in the headwaters and fair to poor in the lower reaches.
- The Mullet River watershed covers the majority of the study area and connects with the Sheboygan River watershed. Crop farming and public and private forestry comprise the majority of the land uses in the watershed. Water quality ranges from good to fair in the watershed and is affected by agricultural and urban runoff, point source discharges in the urban areas, stream channelization, and dams. Over the years, a number of conservation practices have been employed on farms within the watershed including contour plowing, crop rotation, nutrient management planning, designed manure storage installations, grassed waterways, filter strips, stream buffers, and barnyard runoff measures. Use of these farm practices has a beneficial impact on water quality. However, runoff from agricultural lands continues to impact water quality in the watershed and there is a need to further reduce sediment and nutrient impacts to waterways in the Mullet River watershed.

- Water quality in the Onion River watershed ranges from excellent to good in the headwater areas to fair to poor in the lower sections. Agricultural and urban runoff is the primary source of pollution as well as point source discharges. Excessive sedimentation and channelization limit stream habitat quality. The Onion River watershed was one of the very first watersheds targeted under the Nonpoint Source Water Pollution Abatement (Priority Watershed) Program. A follow-up report found that the watershed continues to be affected by nonpoint pollution sources.

Surface Waters

Significant surface water resources located within the study area include the following:

- Lake Winnebago is the largest lake entirely within the state and has two primary tributaries, the Wolf River and the Fox River. It is drained by the Fox River, which flows north toward Green Bay. Lake Winnebago is classified as an impaired water by the state under the Clean Water Act (Section 303(d)). Water quality concerns range from urban stormwater discharge to agricultural runoff. http://en.wikipedia.org/wiki/Lake_Winnebago - cite note-0#cite note-0
- Taycheedah Creek is classified as a warm water sport fish community. Evaluations of water quality in the Taycheedah Creek show that it is in a degraded state. After rainfall or snowmelt, the stream is very turbid and water clarity is very poor. Agriculture and increased urbanization are the suspected sources of pollution.
- Feldner's Creek, located southwest of the village of St. Cloud in Fond du Lac County, is classified as a Class II trout stream. The headwater of Feldner's Creek is also considered an Exceptional Resource Waterway by WDNR, which are characterized by excellent water quality, high recreational value, and high quality fisheries.
- The Sheboygan River originates in east-central Fond du Lac County and flows generally southeastward to the city of Sheboygan where it enters Lake Michigan. The US EPA declared 14 miles of the Sheboygan River east of the study area a superfund site, jeopardizing the integrity and quality of Lake Michigan. Environmental cleanup of the upper portion of the Sheboygan River has been completed. Cleanup efforts for the lower river and inner harbor in the city of Sheboygan will likely be completed by the end of 2012.
- De Neveu Lake is an 80-acre lake in the town of Empire. It has a maximum depth of 67 feet and moderate water clarity. Fish include panfish, largemouth bass, northern pike, and walleye.
- De Neveu Creek is the longest stream in the Lake Winnebago East Watershed. De Neveu Creek is classified as an impaired water by the state under the Clean Water Act (Section 303(d)). The majority of the city of Fond du Lac's stormwater is discharged into De Neveu Creek. Water quality impacts are water turbidity, loss of habitat, hydrologic modifications, sediment, and nutrient loading from urban and rural sources. After snowmelt or rainfall, this stream can become extremely turbid. This stream is also classified as supporting a warm water forage fish community.
- The Mullet River originates at the outlet of Mullet Lake in Fond du Lac County and runs generally east before joining the Sheboygan River in the city of Sheboygan Falls.
- Mullet Lake and Marsh is a 200-acre hard-water seepage lake surrounded by a wetland complex of tamarack, shrub carr, sedge meadow, and swamp forest. The lake and swamp complex is the headwaters of the Mullet River in the priority watershed of the Sheboygan River. This undeveloped inland lake with intact wetland vegetation provides important breeding, nesting, and migratory habitat for numerous bird, reptile, and amphibian species.

- The Onion River flows southerly for about half its length before turning northward, entering the Sheboygan River in Rochester Park in Sheboygan Falls. The headwater of the Onion River, known as Ben Nutt Creek, is a trout stream downstream to the top of the pool formed by the Waldo dam.
- The Plymouth Mill Pond is a 41-acre impoundment of the Mullet River located in the city of Plymouth. The water body is maintained by a dam at the southern end of the pond and it extends north WIS 23. The pond is utilized for boating, fishing, and public ice skating. In recent years, degraded water quality has led to algal blooms and aquatic plant growth, which have caused odor problems, impeded recreational use of the pond, and negatively impacted the aesthetics of the Mill Pond area. A Comprehensive Management Plan was adopted for the pond in 2008.

Other nearby water bodies include the Fond du Lac River, Sheboygan River, Supple Marsh, Wolf Lake, and Long Lake.

Groundwater

Groundwater is an important source of potable water and groundwater contamination has been a significant issue along the Niagara Escarpment for some years. In areas of karst (a geologic formation shaped by the dissolution of layers of soluble bedrock) in the study area, pathways develop for water movement through the rock leading directly to the groundwater with little or no filtration. Surface activities such as agriculture (both crops and grazing), road salting, and non-point source pollution can contaminate water moving directly into the groundwater. The thin soils in the area can create other difficulties including the adverse effects of leaking underground storage tanks or deteriorating septic tanks.

Parks and State Natural and Wildlife Areas

The WIS 23 corridor traverses the northern unit of the Kettle Moraine State Forest in the town of Greenbush. This and other significant parks and state natural and wildlife areas within the study area are described below.

- Kettle Moraine State Forest - Northern Unit is a 27,725-acre forest stretching across Sheboygan, Fond du Lac, and Washington counties. Made up of geological formations caused by retreating glaciers, the forest is managed for forestry and outdoor recreation. Textbook examples of glacial landforms are scattered throughout the forest, such as drumlins, kames, eskers, and kettles. Botanically, the forest is quite diversified with nearly 60 species of trees present, together with numerous shrubs, wild flowers, ferns, and other plant life. This state park is comprised mostly of forests and lakes and provides habitat for a diversity of species, including whitetail deer, hawks, turkeys, raccoons, squirrels, and possums. The Kettle Moraine State Forest – Northern Unit is part of the Ice Age National Scientific Reserve established in 1964 to project glacial landforms and landscapes in Wisconsin. The Wade House State Historic Site, situated in Greenbush at the entrance of the Kettle Moraine State Forest, once served as an inn and stopping point for stage coaches traveling on the Fond du Lac-Sheboygan Plank Road.
- The Ice Age Trail is a 1,000-mile footpath highlighting Wisconsin's ice age heritage. The Ice Age Trail is one of only eleven National Scenic Trails in the country. Within the study area, the trail passes through the towns of Greenbush and Plymouth in Sheboygan County.
- Sheboygan Marsh Park and Wildlife Area is located in northwestern Sheboygan County and contains the largest restored wetland in the Wisconsin watersheds of Lakes Michigan and Superior. It encompasses over half of the towns of Russell and Greenbush and includes about 14,000 acres of land and surface water; 8,166 acres are publicly owned, of which 7,414 acres are owned by Sheboygan County (including the County's Broughton Park) and 752 acres by the state. The remainder is privately owned, some of which is publicly accessible. The marsh adjoins the Ice Age

National Scientific Reserve. Archaeological investigations have classified Sheboygan Marsh as an “archaeological treasure” of national significance; it remains a candidate for nomination to the National Register of Historic Places. The Sheboygan River flows easterly through the marsh.

- The Calvary Marsh public hunting ground is a 280-acre Fond du Lac County-owned property. It is mainly marsh and provides an excellent habitat for wildlife. The property is landlocked and only accessible to the public via the Sheboygan River. Overland access to the public is only available if neighboring landowners grant permission to cross their land. According to the county’s Outdoor Recreation and Open Space Plan, the county would like to acquire land to provide direct public access in the future.
- Mullet Creek Wildlife Area is a 2,217-acre WDNR property in the town of Forest that consists of a rich array of wetland, forest, grassland, and farmland. Mullet Creek flows through the entire property eventually joining the Sheboygan River. The central portion of this property consists of shallow open water with submergent vegetation and cattail wetland totaling over 700 acres. Sedge, reed canary grass, willow, dogwood, swamp conifers, and swamp hardwoods occur in the lowland areas. Oak, aspen, and grass fields occur on the upland sites.
- Mullet Lake State Natural Area is a 495-acre WDNR property located about one-half mile southwest of Mullet Creek Wildlife Area. A 200-acre hard-water seepage lake is surrounded by a wetland complex of tamarack, shrub carr, sedge meadow, and swamp forest. The lake and swamp complex is the headwaters of the Mullet River in the priority watershed of the Sheboygan River. This undeveloped inland lake with intact wetland vegetation provides important breeding, nesting, and migratory habitat for numerous bird, reptile, and amphibian species.
- Old Plank Road Trail is a popular 17-mile trail accommodating bicyclists, runners, walkers, in-line skaters, horseback riders, moped users, skiers, and snowmobiles. The trail parallels WIS 23 from Sheboygan, past Kohler, Sheboygan Falls, Plymouth, and on to historic Greenbush, linking with the Ice Age Trail in the northern unit of the Kettle Moraine State Forest.
- There are numerous snowmobile trails in the study area maintained by area clubs. Private land owners provide the majority of the land used for the public trail system.

Threatened and Endangered Species

Within the WIS 23 corridor area, there are 21 plant and animal species listed as either threatened, endangered, or special concern within the approximately 19 miles between Fond du Lac and Sheboygan Counties. Eight state threatened species and two state endangered species are considered a potentially affected based on WDNR project coordination. The state endangered species include rainbow shell mussel and Midwest Pleistocene vertigo upland snail. State threatened species include the snow trillium, slippershell mussel, ellipse mussel, red-shouldered hawk, cerulean warbler, Acadian flycatcher, hooded warbler, and Blanding’s turtle. More information is contained in Section 3 of the LS SDEIS. The project team worked with WDNR and USFWS to obtain rare species data for the ICE study area, which is larger than the corridor study area. WIS 23 crosses through Empire and Forest Townships in Fond du Lac County and Greenbush and Plymouth Townships in Sheboygan County.

Figure 14 shows the number of rare species occurrences by township, county and cumulative project. This information is provided to summarize the general density of threatened and endangered species in both Fond du Lac and Sheboygan County in comparison to the project alignment and occurrences within the four townships that the project traverses. The Sheboygan County towns of Greenbush and Plymouth contain more threatened and endangered species than towns adjacent to WIS 23 in Fond du Lac County. This is partially based on the presence of the Kettle Moraine Forest in Sheboygan County. Fond du Lac County has 36 reported threatened and endangered species occurrences and Sheboygan County has reported 40.

Figure 14: Rare Species Occurrences in Towns and Counties within ICE Study Area

Town	Town	Range	Rare Plants	Rare Terrestrial Animals (incl. birds)	Aquatic Animals	Total Rare Species per Town (or County)	Total Rare Habitats
Empire (FDL County)	15N	18E	1	--	--	1	-
Forest (FDL County)	15N	19E	--	2	--	2	2
Greenbush (Sheboygan Co.)	15N	20E	2	6	3	11	2
Plymouth (Sheboygan Co.)	15N	21E	4	3	2	9	3
Total Occurrence Summary for all WIS 23 Towns	4	4	6	10	5	20	7
Occurrences Summary for Fond du Lac Co.	T13N to T17N	R14E to R19E	9	19	8	36	30
Occurrences Summary for Sheboygan Co.	T13N to T16N	R20E to R22E	18	14	8	40	33
Occurrence Summary for both WIS 23 Project Counties	4	9	22	10	22	54	39

Threatened and Endangered Species Data obtained from WDNR on-line Natural Heritage Inventory (NHI 11/14/12) and from WDNR correspondence March 2013. Note: Only Threatened and endangered species are included in table. State Special Concern Species were not included in tallies.

Air Quality

The proposed WIS 23 project is located in the Lake Michigan Intrastate Air Quality Control Region. These air quality regions monitor National Ambient Air Quality Standards established by the US EPA under the authority of the Clean Air Act. Primary standards are designed to protect human health with an adequate margin of safety. Secondary standards are designed to protect public welfare from any known or anticipated adverse effect. Figure 15 lists the standards for the different air pollutants and whether they are a primary or secondary standard.

Figure 15: National Ambient Air Quality Standards

Pollutant	Type	Standard	Averaging Time ^a	Regulatory Citation
SO ₂	Primary	0.14 ppm (365 µg/m ³)	24-hour	40 CFR 50.4(b)
SO ₂	Primary	0.030 ppm (80 µg/m ³)	Annual	40 CFR 50.4(a)
SO ₂	Secondary	0.5 ppm (1,300 µg/m ³)	3-hour	40 CFR 50.5(a)
PM ₁₀	Primary and Secondary	150 µg/m ³	24-hour	40 CFR 50.6(a)
PM _{2.5}	Primary and Secondary	35 µg/m ³	24-hour	40 CFR 50.7(a)
PM _{2.5}	Primary and Secondary	15 µg/m ³	Annual	40 CFR 50.7(a)
CO	Primary	35 ppm (40 mg/m ³)	1-hour	40 CFR 50.8(a)(2)
CO	Primary	9 ppm (10 mg/m ³)	8-hour	40 CFR 50.8(a)(1)
O ₃	Primary and Secondary	0.12 ppm (235 µg/m ³)	1-hour ^b	40 CFR 50.9(a)
O ₃	Primary and Secondary	0.075 ppm (150 µg/m ³)	8-hour	40 CFR 50.10(a)
NO ₂	Primary and Secondary	0.053 ppm (100 µg/m ³)	Annual	40 CFR 50.11(a) and (b)
Pb	Primary and Secondary	0.15 µg/m ³	Rolling 3 months	40 CFR 50.1

^a Each standard has its own criteria for how many times it may be exceeded, in some cases using a three year average.

^b As of June 15, 2005, the 1-hour ozone standard no longer applies to areas designated with respect to the 8-hour ozone standard (which includes most of the United States, except for portions of 10 states).

The EPA uses six criteria pollutants as indicators of air quality: ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, and lead. The EPA's National Ambient Air Quality Standards (NAAQS) for each criteria pollutant are intended to protect public health and welfare. Areas where air pollution levels persistently exceed these standards may be designated "nonattainment."

The EPA designated ten counties in Wisconsin, including Sheboygan County, as nonattainment areas for the 8-hour NAAQS for ozone, meaning the recorded ozone levels exceed the acceptable federal air quality standards during 8-hour periods. According to current EPA guidelines, once a nonattainment designation takes effect, state and local governments must develop implementation plans outlining how areas will attain and maintain the standards by reducing air pollutant emissions contributing to ground-level ozone concentrations.

In 2009, WDNR submitted an 8-Hour Ozone Redesignation Request and Maintenance Plan for the ten counties in Wisconsin, including Sheboygan County. On July 31, 2012, EPA published this final rule regarding the attainment status of Sheboygan County.

40 CFR Parts 52 and 81

[EPA-R05-OAR-2009-0730; FRL-9702-9]

SUMMARY: EPA is approving a request from the Wisconsin Department of Natural Resources (WDNR) to redesignate the Milwaukee-Racine area to attainment for the 1997 8-hour National Ambient Air Quality Standard (NAAQS or standard). The Milwaukee-Racine area includes Milwaukee, Ozaukee, Racine, Washington, Waukesha, and Kenosha Counties. WDNR submitted this request on September 11, 2009, and supplemented the submittal on November 16, 2011. These submittals also requested the redesignation of the Sheboygan area (Sheboygan County) to attainment for the 1997 8-hour ozone NAAQS. EPA proposed to approve the redesignation of both areas on February 9, 2012, and provided a 30-day review and comment period. EPA received comments submitted on behalf of Sierra Club and Midwest Environmental Defense Center and from the Wisconsin Manufacturers and Commerce. EPA is not taking final action on the Sheboygan redesignation request at this time because preliminary 2012 ozone monitoring data indicate that the area has violated the 1997 standard. In addition to approving the redesignation of the Milwaukee-Racine area, EPA is taking several other related actions. EPA is approving, as a revision to the Wisconsin State Implementation Plan (SIP), the State's plan for maintaining the 1997 8-hour ozone standard through 2022 in the Milwaukee-Racine area. EPA is approving the 2005 emissions inventories for the Milwaukee-Racine and Sheboygan areas as meeting the comprehensive emissions inventory requirement of the Clean Air Act (CAA or Act). Finally, EPA finds adequate and is approving the State's 2015 and 2022 Motor Vehicle Emission Budgets (MVEBs) for the Milwaukee-Racine area.

Wind Energy

The development of wind energy generators and transmission has emerged in the study area in recent years. The Cedar Ridge Wind Farm, located in the towns of Empire and Eden (just south of the study area), has been in operation since December 2008. Cedar Ridge is situated on the Niagara Escarpment, a ridgeline that peaks at 1,200 feet, and offers an exceptional wind resource. Cedar Ridge is spread out over 12.2 square miles on 7,800 acres. Its 41 turbines produce approximately 68 megawatts of energy, enough to power about 17,000 homes a year. Seventeen of the 41 turbines are located in the town of Empire.

The Blue Sky Green Field Wind Energy Center is also situated on the Niagara Escarpment. Blue Sky is located in the towns of Marshfield and Calumet (just north of the study area) and consists of 88 turbines producing 145 megawatts of energy, enough to power 36,000 homes per year. Forty-four of the 88 turbines are in the Town of Marshfield. Blue Sky has been in operation since May 2008.

Historic and Archeological Resources

Within the broader ICE study area there are numerous historic resources. Wisconsin's Architecture and Historic Inventory (AHI) is a search engine that provides historical and architectural information for about 120,000 properties within Wisconsin. Listing on the AHI is not an indication of whether the property is eligible for the NRHP. This resource indicates that there are 4,155 listings for Fond du Lac County and 2,655 listings for Sheboygan County.

Directly within the WIS 23 corridor there are 17 potential historic sites and another 2 sites associated with the connection roads and interchange. Effects to all these resources were avoided except for those discussed below. Among historic resources potentially directly affected by WIS 23 alternatives are two historic, and one archaeological, resources eligible for or on the National Register of Historic Places (NRHP). The St. Mary's Springs Academy is on the east end of Fond du Lac and has two contributing buildings that are built in the Georgian Revival style, and Richardsonian Romanesque Revival style. It is associated with the Sisters of St. Agnes of the Roman Catholic Church. The Old Wade House is now a state park near the Kettle Moraine State Forest and is run by the State Historical Society. It is a living history portrayal of a restored stagecoach inn built around 1850. Within the park are three buildings that are on the National Register of Historic Places. The Sippel archaeological site is a small Yankee homestead/farm in the town of Greenbush. It was occupied between 1848 and 1875. The owners and inhabitants played instrumental roles in the early development of the Greenbush community, serving as farmers and merchants.

Existing Land Uses

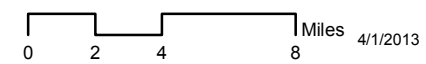
Existing land uses in the study area are depicted on Map 8. The WIS 23 study area passes through rural and urban landscapes. The largest urban areas in the study area are the cities of Fond du Lac and Plymouth. As depicted on Map 8, agriculture is the predominant land use in the unincorporated towns, with scattered, low density housing either associated with farm operations or located in rural subdivisions served by septic and private well systems. Small areas of non-urban commercial development are also scattered throughout the study area. The majority of large woodlands and environmental corridors within the study area are located within the Kettle Moraine State Forest, Sheboygan Marsh Park and Wildlife Area, and other state and/or county owned natural areas.



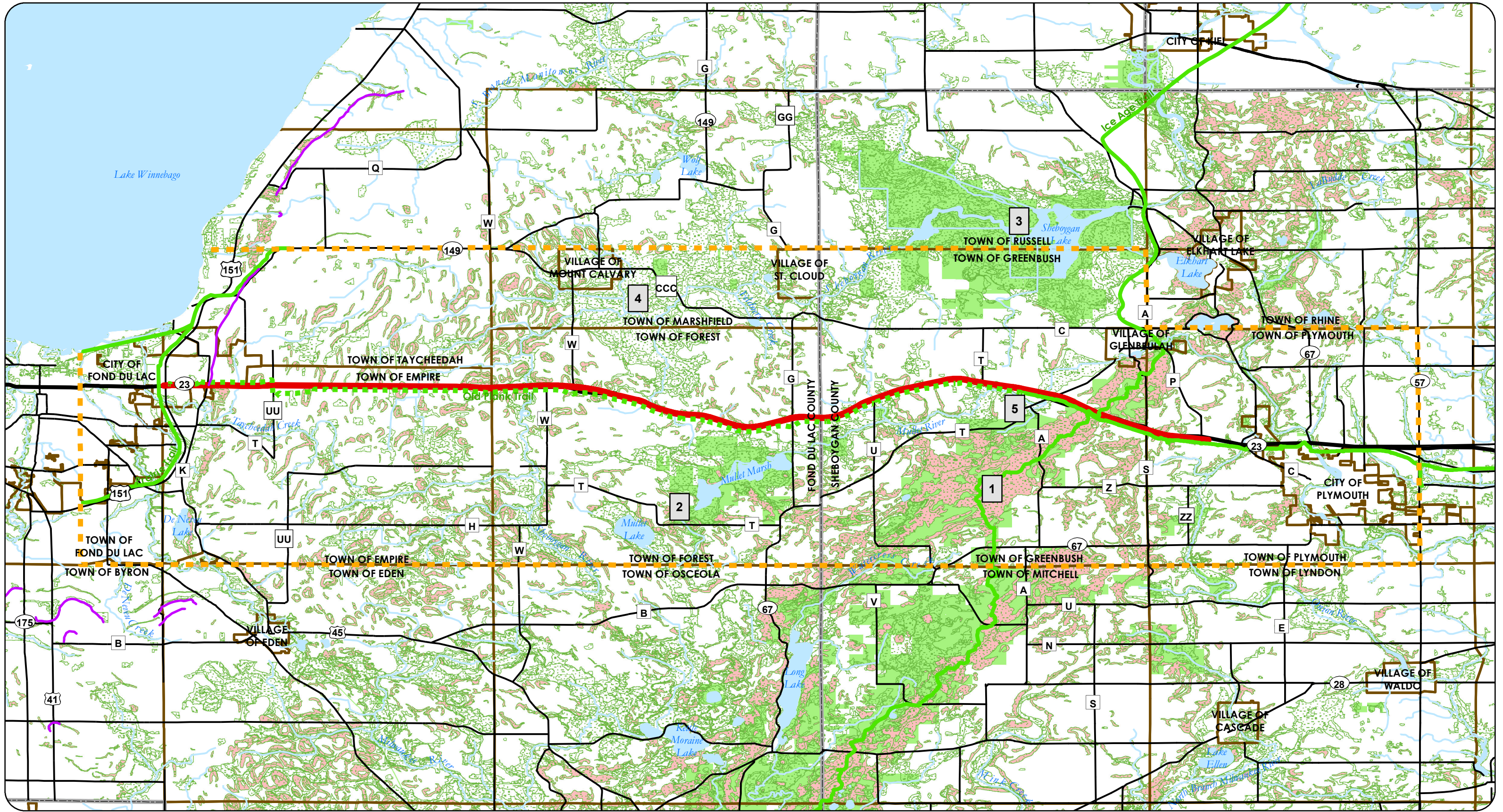
WIS 23
Supplemental EIS
Map 6: Agricultural Resources
Sources: Fond du Lac County, Sheboygan County, USDA,
US Census Bureau, Strand Associates, Vandewalle & Associates

- Major Road
- Local Road
- WIS 23 Build Alternative
- WIS 23 ICE Study Area
- County Boundary
- Municipal or Town Boundary
- Surface Water

- Soil Capability Class**
- Class I
 - Class II
 - Class III - VIII



Draft: February 24, 2014



WIS 23
Supplemental EIS
Map 7a: Natural Resources

Sources: Fond du Lac County, Sheboygan County, WIDNR, FEMA, ECWRPC, US Census Bureau, Strand Associates, Vandewalle & Associates. Niagara Escarpment Outcrop digitized by Bay Lake RPC, based on field data from J. Kluessendorf and D. Mikulic (2000).

0 0.5 1 2 Miles

4/1/2013



- WIS 23 Build Alternative
- WIS 23 ICE Study Area
- Major Road
- Existing Trail
- Proposed Trail

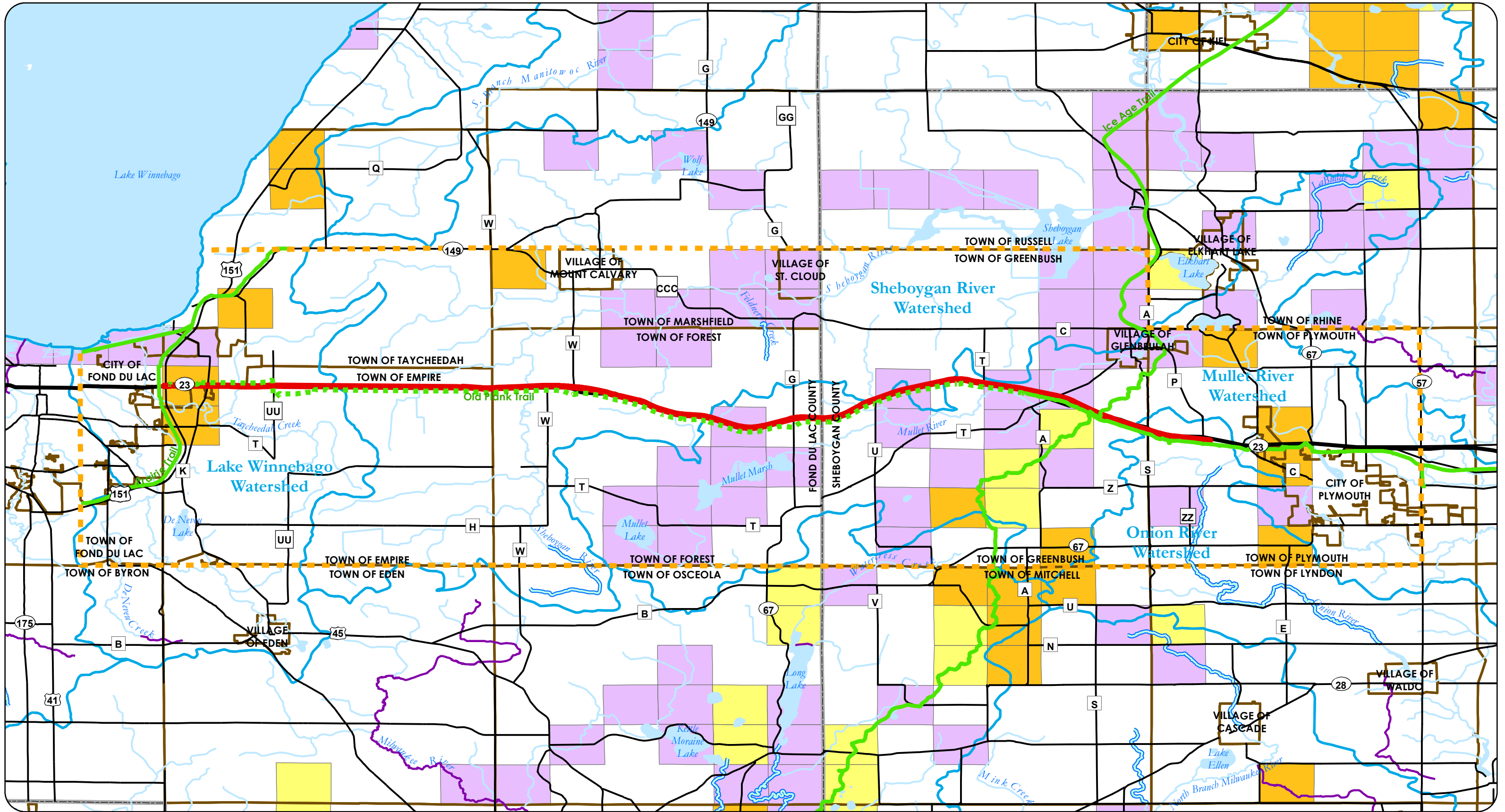
- County Boundary
- Municipal or Town Boundary
- Parks and Wildlife Areas

- Niagara Escarpment Outcrop
- Environmental Corridor
- Public Lands
- Slopes greater than 12%
- Surface Water

Parks and Wildlife Areas

1. Kettle Moraine State Forest - Northern Unit
2. Mullet Creek Wildlife Area
3. Sheboygan Marsh Park and Wildlife Area
4. Calvary Marsh
5. Wade House State Historic Site

Draft: February 24, 2014



WIS 23 **Supplemental EIS** Map 7b: Natural Resources

Sources: Fond du Lac County, Sheboygan County, WI Natural Heritage Inventory, US Census Bureau, Strand Associates, Vandewalle & Associates

0 0.5 1 2 Miles

4/1/2013



- WIS 23 Build Alternative
- - - WIS 23 ICE Study Area
- Major Road
- Existing Trail
- - - Proposed Trail

- County Boundary
- Municipal or Town Boundary

- Impaired Streams (303d)
- Exceptional Resource Waters
- Watershed Boundaries
- Surface Water

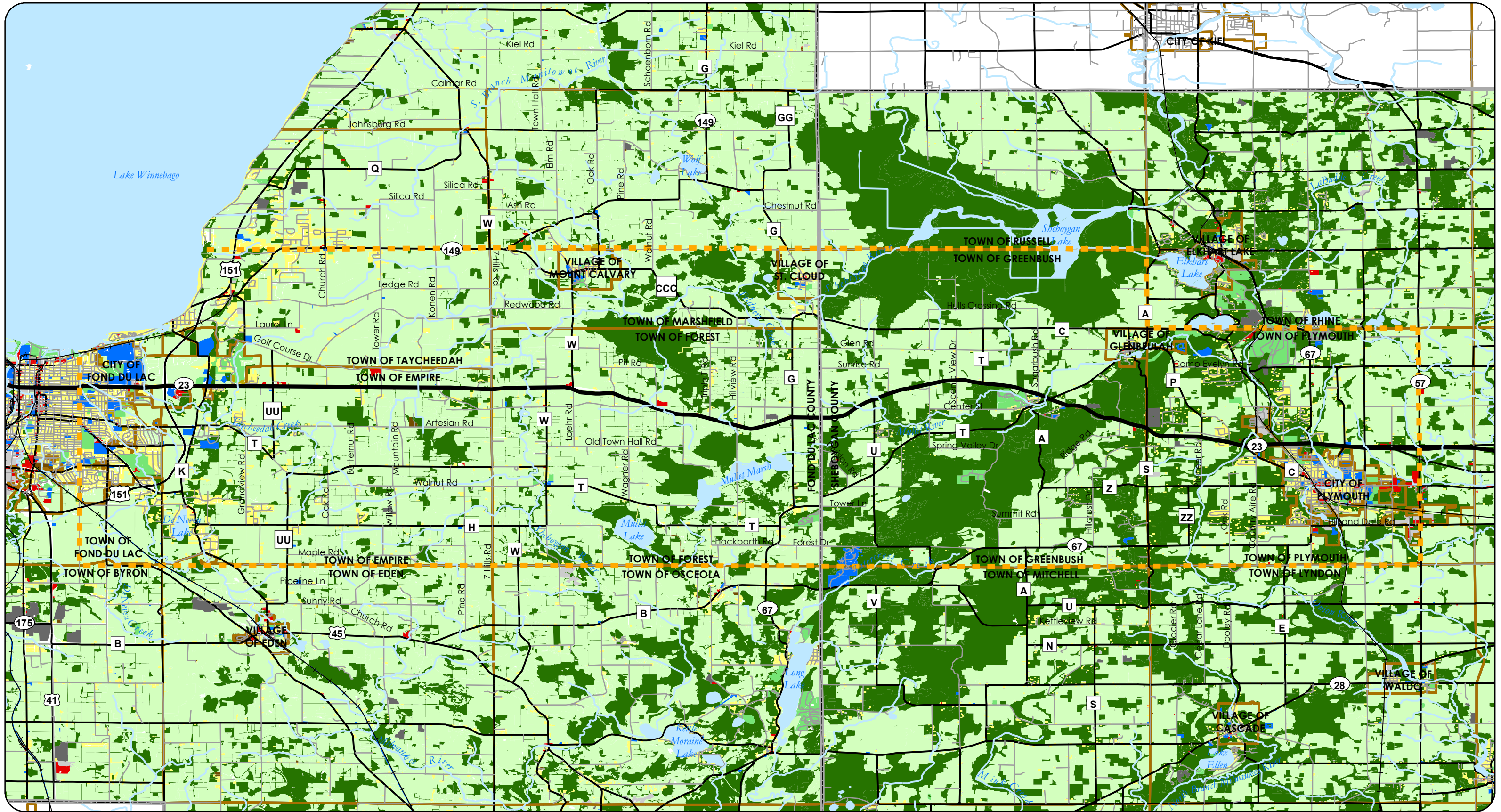
Sections with Endangered Species

- Aquatic
- Both Aquatic and Terrestrial
- Terrestrial

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39
C-45

Appendix LS-C



WIS 23 **Supplemental EIS**

Map 8: Existing Land Use

Sources: Fond du Lac County, Sheboygan County, WIDNR, ECWRPC, US Census Bureau, Strand Associates, Vandewalle & Associates

0 0.5 1 2 Miles

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--- WIS 23 ICE Study Area

— Major Road

— Local Road

— Surface Water

— County Boundary

— Municipal or Town Boundary

Existing Land Use

Single and Two Family Residential
Multi-Family Residential
Mobile Homes

Commercial
Industrial
Extraction
Institutional / Community Facility

Agriculture / Vacant
Public Open Space
Woodlands/Environmental Corridor

Review of Federal, State, County, Regional and Local Plans and Initiatives

The study team collected and reviewed land use, transportation, and other planning documents pertinent to the study area to understand the future of land use, transportation, natural resources, and economic development as well as potential impacts that may result from the proposed project alternatives. These documents are summarized below. Plans current as of January of 2012 were used in this analysis.

Federal and State Plans and Initiatives

Ice Age National Scientific Reserve

The Ice Age National Scientific Reserve was established in 1964 to protect the glacial landforms and landscapes in Wisconsin. The reserve is an affiliated area of the National Park System and consists of nine units across Wisconsin, including the Kettle Moraine State Forest – Northern Unit in the study area. Most of these units are connected by the Ice Age Trail. The units protect different areas of scenic and scientific value and provide all kinds of opportunities, from studying Wisconsin’s natural history at one of the interpretive centers, to hiking, camping, sightseeing and wildlife viewing.

WisDOT Connections 2030 Plan (2009)

Connections 2030 is the long-range transportation plan for the state that addresses all transportation modes and identifies policies and implementation priorities to aid transportation decision makers when evaluating program and project priorities. The plan identifies system-level priority corridors that serve critical sectors of the economy or major population centers, carry significant passenger and freight traffic, show significant growth in travel or economic development, and serve an important role for other transportation modes.

The Connections 2030 Plan includes the Corridors 2030 State Highway Plan that identifies a network of “Backbone” and “Connector” highways. The Backbone System includes the highest value multi-lane (or planned multi-lane) divided highways, which connect all regions and major economic centers in the state and are tied to the national transportation network. The Connector System includes high-quality two- and four-lane highways that connect all other significant economic and tourism centers to the Backbone System. WIS 23 is identified as a one of these system-level priority corridors and categorized as a “Connector,” referred to in the plan as the Kettle Country Corridor. Key transportation recommendations for the corridor include: improve user efficiency, mobility, and traffic movement along WIS 23 including expanding to four lanes; increase direct air service and infrastructure projects to support business airplane-capable airports; increase regional coordination and continued service, including bus connections between Madison and Green Bay and Madison and Sheboygan with stops in Fond du Lac; and enhance bicycle and pedestrian linkages and accessibility along and across facilities.

Wisconsin Working Lands Initiative (2009)

Signed into law in 2009, the Wisconsin Working Lands Initiative is comprised of the following programs, all of which are administered by the Wisconsin Department of Agriculture, Trade, and Consumer Protection (WDATCP).

- Wisconsin Farmland Preservation Tax Credits Program provides landowners with an opportunity to claim farmland preservation tax credits that are applied against tax liability. To be eligible, acres claimed for the tax credit must be located in a farmland preservation area that is identified in a certified county farmland preservation plan.
- An Agricultural Enterprise Area (AEA) is defined as a contiguous land area devoted primarily to agricultural use and locally targeted for agricultural preservation and agricultural development. Over the two-year pilot period of this program, the State is authorized to designate up to 15 AEAs and up to 200,000 acres of farmland. Land eligible for AEA designation must be a contiguous land area, primarily in

agricultural use, and located in a farmland preservation area as identified in a certified county farmland preservation plan.

- The Purchase of Agricultural Conservation Easements (PACE) Program provides state funding for the purchase of agricultural conservation easements to prohibit development that would make the farmland unsuitable or unavailable for agricultural use. The easements are completely voluntary and allow the landowner to be compensated for limiting the development potential of the farmland. Agricultural Conservation Easements are permanent and are carried over to subsequent landowners as property is sold.

Wisconsin Land Legacy Report (2007)

This report by WDNR identifies 229 legacy places that are considered to be of utmost importance to meet the state's conservation and recreation needs over the next 50 years. Two of these areas are located within the study area.

- Sheboygan River Marshes: The Sheboygan River provides the common thread for linking three major wetland areas together. At the headwaters of the river is the St. Cloud Marsh, almost entirely in private ownership. A few miles downstream is the Sheboygan Marsh County Park and State Wildlife Area, which together provide over 8,000 acres of publicly owned land. Further downstream is the Kiel Marsh State Wildlife Area, which is about 800 acres in size. The uplands bordering the wetlands are primarily devoted to agriculture. Protecting the open space around and between these three wetlands would buffer them from conflicting land uses and would link them together in an ecologically valuable corridor.
- Kettle Moraine State Forest: There are presently five separate units of the Kettle Moraine State Forest. The large Northern (in the study area) and Southern Units together total about 50,000 acres and comprise the majority of the State Forest. In between these large units are the much smaller Lapham Peak, Loew Lake, and Pike Lake Units, which total less than 3,000 acres. Lying in proximity to the Milwaukee metropolitan area, the State Forest is very heavily used for hunting, fishing, camping, swimming, hiking, cross-country skiing, horseback riding, snowmobiling, and off-road biking. In some cases, recreation demand has exceeded the desired level of use and conflicts between users, as well as degradation of some natural communities, have occurred. The Ice Age Trail corridor runs the full length of the Kettle Moraine, although many segments are not completed. Completing the Trail and finding ways to disperse and alleviate the demand for recreation opportunities in the Kettle Moraine remains a priority.

Wisconsin Wildlife Action Plan (WWAP) (2005)

Wisconsin DNR prepared the WWAP report, which discusses management opportunities to maintain and protect Wisconsin's natural landscapes and species of the greatest concern. The WIS 23 study area lies within the Southeast Glacial Plains ecological landscape. The pre-settlement vegetation of this landscape has been significantly altered by agricultural and urban development. Most of the rare natural communities that remain are associated with large moraines or in areas where the Niagara Escarpment occurs close to the surface. The plan identifies the following management opportunities to protect and restore these important features:

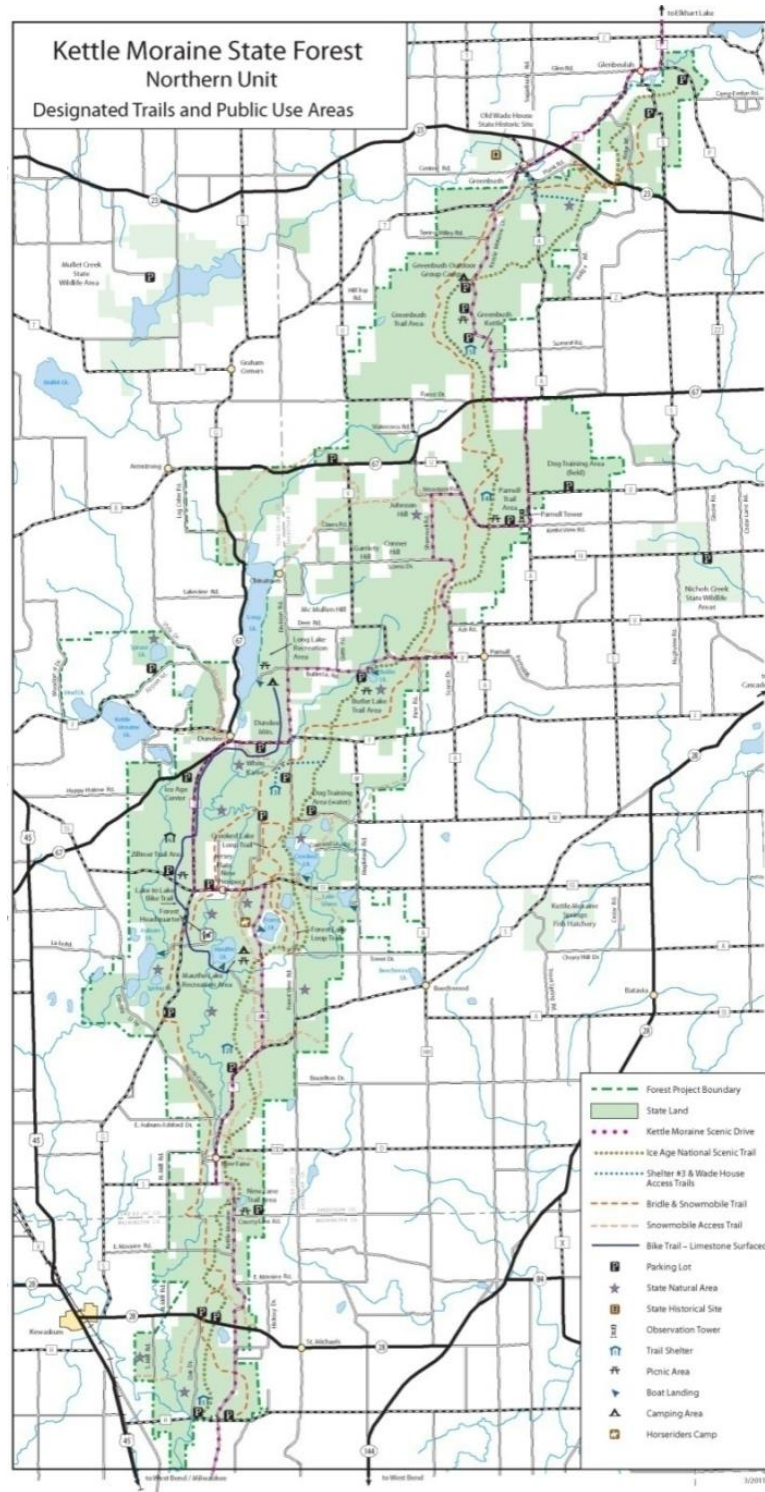
- Protection of the Niagara Escarpment, glacial eskers, and drumlin fields that are unique and in some cases world-renowned features.
- Restoration of large-scale oak forests and savannas, as well as to manage for forest interior species and rare fen plants in the Kettle Moraine.
- Linking scattered woodlots and controlling non-indigenous invasive species throughout the Ecological Landscape.

Kettle Moraine - Northern Unit Master Plan (2001)

The master plan serves as a guide for the management of the Kettle Moraine State Forest. Goals identified in the master plan include acquisition of approximately 7,000 acres of new land (see Figure 16), restoration

activities, construction of new facilities such as shelters and overlooks, and improvements to land and resource management practices to protect wildlife and enhance recreation.

Figure 16: Kettle Moraine State Forest – Northern Unit Designated Trails and Public Use Areas



The Niagara Escarpment Inventory of Findings 1999-2001 and Considerations for Management (2002)

This report was prepared by the Natural Heritage Inventory program of the Wisconsin Department of Natural Resources' Bureau of Endangered Resources. The Niagara Escarpment is a statewide critical natural resources area because of its unique geology, the number of rare plants and animals that rely on the escarpment's distinct microclimate, and the land's sensitivity to groundwater contamination. The report is intended as a tool to evaluate the ecological significance of the escarpment and provide background for conservation efforts and management considerations. The report identified the following threats to the Escarpment: land use conflicts, development, road construction, mining, quarrying, tower placement, recreation, invasive/exotic species, hydrologic disruption, groundwater contamination, and administrative inconsistency. The report also listed a range of management considerations that would contribute to conservation of the Niagara Escarpment's biodiversity including monitoring and management, protection and planning, communication and landowner education, and inventory needs.

Niagara Escarpment Greenway Plan (In Progress)

The Niagara Escarpment Resource Network is in the process of preparing a greenway plan to identify significant sites and features of in the Niagara Escarpment and key connecting routes for future trails. The plan is expected to be completed in summer 2012.

Wade House Master Plan (In Progress)

At the time of writing, the Wisconsin Historical Society was in the process of preparing a master plan for the Wade House historic site.

FEIS Learning & Visitor Center and Wesley Jung Carriage Museum (2011)

An FEIS was prepared in February 2011 for construction of a new learning and visitor center and carriage museum within the Wade House historic site with proposed access from WIS 23. The FEIS indicates there are no anticipated changes in traffic patterns on WIS 23 associated with the project. However, the FEIS discusses WisDOT plans to expand WIS 23 to four lanes between Plymouth and Fond du Lac. The FEIS further indicates that access off of WIS 23 will be located across from an existing farm road near the western portion of the project area. This location accommodates safety concerns and anticipated traffic volume. Current access to Wade House Historic site via Plank Road will not be changed as part of this project. However, potential changes to ingress/egress to Old Plank Road from WIS 23 and possible closure would occur if a County A interchange is constructed.

Regional and County Plans and Initiatives

Bay-Lake Regional Planning Commission Comprehensive Plan (2005)

This comprehensive plan is the initial plan for the Bay-Lake Region covering an eight county area in northeastern Wisconsin that includes Brown, Door, Florence, Kewaunee, Manitowoc, Marinette, Oconto and Sheboygan counties. The plan was prepared to serve as a guide for future land use planning decisions throughout the region; to serve as a framework plan from which county and local plans can be carried out in greater detail; and to meet the requirements of Wisconsin's comprehensive planning law (1999 Wisconsin Act 9) adopted under the authority granted by Section 66.1001 of the Wisconsin Statutes.

The plan is an advisory document that provides a specific guide as to where future conservation, growth and development should occur within the region. Information collected by the Commission was provided to communities in the region and may help in the development of local and county comprehensive plans. The plan will be consulted when the Commission makes decisions concerning land use and other issues impacting the development of the region. Policies in local comprehensive plans control in cases of conflict. This plan does not reference the potential WIS 23 expansion.

East Central Wisconsin Regional Comprehensive Plan 2030 (2008)

The East Central Wisconsin Regional Planning Commission developed a region-wide framework plan for the 10 counties that it represents: Calumet, Fond du Lac, Green Lake, Marquette, Menominee, Outagamie, Shawano, Waupaca, Waushara, and Winnebago. The plan addresses all nine elements specified in the state legislation. The plan's focus is to identify issues of regional significance and to develop policy and best practice examples to help guide future land use decisions within the region. Policies in local comprehensive plans control in cases of conflict.

The plan recommends implementation of the WIS 23 expansion from Plymouth to Fond du Lac and further indicates that connection of WIS 23 to US 151 should, where practical, avoid any potential negative impacts on the Niagara Escarpment.

Long-Range Transportation and Land Use Plan for the Fond du Lac Metropolitan Planning Organization (2005)

This plan was prepared to meet the requirements of TEA-21 for long-range transportation and land use in metropolitan areas. Regarding land use, this plan recommends implementing local land use plans such as comprehensive plans. The plan identifies WIS 23 as the third most important route serving the Fond du Lac area and recommends that the MPO continue to work with WisDOT to identify additional safety improvements. The Plan supports expansion of WIS 23 to a 4-lane highway from Rolling Meadows Drive to Town Line Road. This report suggests that the expansion of WIS 23 will accommodate projected future traffic as well as create economic development opportunities.

Year 2035 Sheboygan Area Transportation Plan (2011)

According to federal regulations, metropolitan planning organizations (MPOs) are required to complete short and long-term transportation plans for urbanized areas with populations of 50,000 or more. The Sheboygan MPO prepared and adopted the Year 2035 Sheboygan Area Transportation Plan in October of 2006 and most recently updated it in 2011. The 2035 SATP is intended to guide local government decision-making in transportation planning through 2035. The plan accounts for the WIS 23 Build Alternative in its air quality conformity analysis. While the plan references the potential for WIS 23 expansion, it does not include recommendations or preferences. The plan also identifies the future extension of the Old Plank Road Trail with the Prairie Trail in the city of Fond du Lac.

Fond du Lac County Comprehensive Plan

Fond du Lac County's comprehensive plan dates from the 1960s. Because all towns in the county administer their own zoning ordinances, the county does not intend to update this plan in the near term.

Fond du Lac County Outdoor Recreation and Open Space Plan (2006)

This plan is intended to guide the county recreation and park development and enable it to participate in state and federal recreation grant programs. Within the study area the plan recommends purchasing land for access to the county-owned Calvary Marsh along the Sheboygan River near Mt. Calvary and purchasing land for a new County park near the city of Fond du Lac within the Niagara Escarpment. The plan does not reference the potential extension of the Old Plank Road Trail that is proposed as part of the WIS 23 expansion. The county is currently working to update this plan.

Fond du Lac County Farmland Preservation Plan (2012)

This plan establishes public policy in support of farmland preservation, agricultural development and the encouragement of a healthy agricultural economy. This plan is intended to minimize conflicts between farm and nonfarm land uses. The plan identifies areas of agricultural use and agriculture related use, as well as areas of nonagricultural development. Within the study area, a majority of the area in Fond du Lac county that is east of County Highway UU, is identified for agricultural use or agriculture related use.

Sheboygan County Comprehensive Plan (2009)

This plan seeks to generate goals, devise strategies, and provide recommendations the county can follow to achieve its desired development pattern. Because all local communities in Sheboygan County administer their own ordinances (e.g., zoning, building permits, etc.), the county's future land use map is composed of each local community's future land use map. More detailed discussion is provided below for each of those local plans.

Sheboygan County Outdoor Recreation and Open Space Plan (2007)

This plan is intended to guide local communities and Sheboygan County in the maintenance and development of outdoor recreation facilities. In addition, this plan provides five-year eligibility for participation in the state of Wisconsin Stewardship Programs. High priority future land acquisitions within the study area include:

- Tracts of forest contiguous to the Kettle Moraine State Forest-Northern Unit in the town of Greenbush.
- Land in the riparian areas and wetlands along the Onion River in the town of Plymouth.
- Land adjacent to the Broughton Sheboygan Marsh Park & Wildlife Area in the town of Greenbush.
- Extending the Old Plank Road Trail from Greenbush west to the county line.

Sheboygan County Farmland Preservation Plan (2005)

This plan was developed to aid in the preservation of productive agricultural lands for continued agricultural use and the protection of farm operations from conflict with incompatible uses, sustaining agriculture as a viable part of the county's economy. The plan identifies agricultural preservation areas and agricultural transition areas. Within the study area, approximately half of the town of Greenbush (west-central and southeastern areas) and about one-third of the town of Plymouth (northeastern area) have been identified for agricultural preservation.

Sheboygan County Natural Areas and Critical Resources Plan (2004)

This plan provides an inventory of the agricultural, natural, and cultural resource features in Sheboygan County that may affect local planning processes. The general policies and programs outlined in the plan are intended to preserve, enhance, and further protect the county's natural areas.

Local Plans and Initiatives

Maps 9a (for towns) and 9b (for cities and villages) illustrate a compilation of future land use plans for the study area communities as established through each local government's comprehensive plan. Two maps are provided because (1) State Statutes allow cities and villages to plan for future land uses within their extraterritorial jurisdictions (either 1.5 or 3 miles from their municipal boundary) and (2) there is no requirement for plans to match one another.

City of Fond du Lac Comprehensive Plan (2009)

The future land use plan (which includes the city and its immediate periphery) shows residential and commercial development occurring on the east side of the city over the next 20 years. Residential development is planned to extend from the current developments on the east side of Fond du Lac to County UU, on both the north and south sides of WIS 23. Commercial and institutional development is planned for all four quadrants of the US 151/WIS 23 interchange.

Through a formal intergovernmental boundary/service agreement developed under Wisconsin State Statutes 66.30, the city of Fond du Lac and the neighboring towns of Fond du Lac, Empire, and Taycheedah have identified future urban growth areas within the study area. This agreement spells out the specific areas in

which urban growth will be allowed within the city and towns and how annexations to the city will be dealt with. This agreement will be a major determinant of future growth patterns within the urbanized area.

Fond du Lac Sewer Service Area Plan (2001)

Sewer service area plans serve as a basis for WDNR approval of state and federal grants for the planning and construction of wastewater collection and treatment facilities. They also serve as a basis for WDNR approval of locally proposed sanitary sewer extensions and private sewer laterals. The Fond du Lac Sewer Service Area is forecast to have a moderate level of growth in the planning period; this plan allocates future growth area acreages within each sewer service area that are not location-specific.

Fond du Lac Land and Water Resource Management Plan (2007)

The Land and Water Resource Management Plan is required by §92.10, Wis. Stats. to evaluate resource conditions and issues in Fond du Lac County and present a plan to address those issues. Key plan goals include the following:

- Maintain soil productivity and reduce soil erosion and sedimentation.
- Minimize the impacts of land disturbing and land development activities within the county.
- Minimize runoff, leaching, and drift of nutrients and pesticides to surface and ground water.
- Reduce the impacts from runoff and storage of animal waste and feed.
- Protect and conserve groundwater quality and quantity within the county.
- Minimize impacts of runoff from urban areas.
- Develop and improve coordination of lake organizations.
- Restore and preserve critical fish and wildlife habitats.
- Minimize the threat and spread of exotic and invasive species.
- Use less energy and improve air quality.

City of Plymouth Comprehensive Plan (2001)

Plymouth's comprehensive plan was prepared in 2001. The state's comprehensive planning law requires plans be updated every ten years, suggesting that the city may update its plan in the near term. The land use plan identifies future residential development adjacent to WIS 23 east of County E. The city plans for future office development west of County E toward WIS 57. Agricultural preservation is planned for lands north of WIS 23 lying west of County E and lands north and south of WIS 23 west of WIS 57.

Village of Mt. Calvary Comprehensive Plan (2009)

The village of Mt. Calvary is located about 3 miles north of WIS 23. Residential and public/government uses are planned adjacent to County W. The planned land use map also identifies the continuation of agriculture in the near term on the village's east side. No additional land outside the current municipal boundary is identified for development within the 20 year planning period.

Village of St. Cloud Comprehensive Plan (2009)

The village of St. Cloud is a small village located approximately 3 miles north of WIS 23. The village's land use plan does not anticipate additional development. Agriculture and open space are the predominant land uses identified for the majority of the undeveloped portions of the village. Existing nonresidential and residential development are anticipated to remain.

Village of Glenbeulah Comprehensive Plan (2008)

The village of Glenbeulah is located approximately 2 miles north of WIS 23. The village's 20-year land use plan indicates additional future residential development in the north and northeast portions of the village, with some additional commercial development located towards the center of the village just off of County A. The village's plan raises a concern that the WIS 23 expansion project could impact the village; businesses may be encouraged to locate to future interchange areas outside the village's planning area and new residents may be attracted by moderate home prices and a shorter commute to neighboring cities.

Town of Taycheedah Comprehensive Plan (2009)

The town of Taycheedah's plan shows the eastern part of the town remaining in agricultural use with growth concentrated along the Lake Winnebago shoreline, north of the city of Fond du Lac.

Town of Taycheedah Zoning Ordinance and Map (2011)

The majority of town lands have been placed in the exclusive agricultural zoning district, which requires a minimum lot size of 35 acres. The minimum lot size to establish a separate parcel for an additional residence is 20,000 square feet. Nearly all lands within the study area are zoned exclusive agricultural with the exception of areas zoned agricultural transition adjacent to the city of Fond du Lac and an area zoned residential estate at the southeast corner of the town.

Town of Plymouth Comprehensive Plan (2009)

This plan shows the majority of town lands remaining in agricultural or open space use. However, the town plan identifies lands adjacent to WIS 23, north of the city of Plymouth, as future commercial development. In addition to adopting a comprehensive plan, the town and city of Plymouth entered into an agreement, similar to a boundary agreement, to establish a modified extraterritorial zoning area.

Town of Plymouth Zoning Ordinance and Map (2006)

The majority of town lands have been placed in the prime agricultural zoning district, which requires a minimum lot size of 35 acres. The town also adopted upland and lowland zoning to protect wetlands and woodlands. Areas zoned for commercial development are located to the east of the city of Plymouth.

Town of Empire Comprehensive Plan (2007)

The town of Empire's future land use plans do not show any development changes along the WIS 23 corridor, except for at the intersection of County UU and WIS 23, which is planned for small-scale commercial and industrial development. The remainder of town land along the WIS 23 corridor is planned for long-term agricultural use.

Town of Empire Zoning Ordinance and Map (2011)

The majority of town lands have been placed in the exclusive agricultural zoning district, which requires a minimum lot size of 35 acres. Most of the land adjacent to the WIS 23 corridor has been zoned exclusive agricultural except for the following locations: land at the County UU intersection with WIS 23 is zoned as residential, business, or agricultural transition; lands east of Tower Road are zoned for residential and agricultural transition; and the area north of WIS 23 at the far east end of the town is zoned residential.

Town of Greenbush Comprehensive Plan (2008)

The town of Greenbush's plan indicates a desire to preserve the majority of town lands for agricultural use with some commercial and/or residential development planned for the County A and WIS 23 interchange and additional residential development in the village of Glenbeulah where it can be served by municipal sewer and water. The town's plan indicates that the WIS 23 expansion project could impact the town and that it is important to maintain highway access to unincorporated Greenbush, the Wade House, and the Kettle Moraine State Forest.

Town of Greenbush Zoning Ordinance and Map (2008)

The majority of land in the town of Greenbush has been zoned either conservancy or agricultural. The town's exclusive (A-1) agricultural district requires a minimum lot size of 35 acres. The C-1 lowland conservancy district does not permit the construction of new buildings. The C-2 upland conservancy district requires a minimum lot size of 10 acres. The majority of lands adjacent to the WIS 23 corridor are zoned either A-1 or C-1. Land near the hamlet of Greenbush is zoned A-3 which is an agricultural transition district planned for eventual urban development.

Town of Fond du Lac Comprehensive Plan (2005)

The town of Fond du Lac land use plan anticipates the remaining northeastern town lands will be annexed by the city of Fond du Lac over the course of the planning period. On the west end, the town plans for continued growth of commercial areas along the WIS 23 corridor beyond the study area.

Town of Fond du Lac Zoning Ordinance (2006) and Map (2010)

The land within the town of Fond du Lac that lies within the study area is zoned primarily exclusive agriculture with some areas zoned agricultural transition or rural residential. The exclusive agricultural district requires a minimum lot size of 35 acres.

Town of Forest Comprehensive Plan (2003)

The town of Forest land use plan anticipates few land use changes from existing uses; however, the plan indicates some additional unspecified development along WIS 23 and county roads. The town intends to update their comprehensive plan in 2012.

Town of Forest Zoning Map (2011)

The majority of town lands have been placed in the exclusive agricultural zoning district. Nearly all lands adjacent to WIS 23 in Forest are zoned in the exclusive agricultural district except for the following locations: business zoning at the intersection of WIS 23 with County W and Hickory Road; residential zoning at the intersection of WIS 23 with Log Tavern Road and Triple T Road; and business and residential zoning at the intersection of WIS 23 with County G. Some of these areas are currently developed.

Town of Marshfield Comprehensive Plan (2009)

The town of Marshfield land use plan anticipates few land use changes from existing uses; however, the plan indicates some additional agricultural transition development may occur around the village of Mount Calvary. In addition, the town of Marshfield, along with the neighboring town of Calumet, is the site of the Blue Sky Green Field Wind Farm, which consists of 88 turbines. The existence of these turbines is somewhat controversial; the town therefore established a Wind Turbine Committee to "monitor" or "mediate" issues that residents have concerning the turbines, such as noise.

Town of Marshfield Zoning Ordinance and Map (2011)

The majority of town lands have been placed in the farmland preservation zoning district, which requires a minimum lot size of 10 acres. The creation of a separate parcel for new nonfarm residences or the conversion of a farm residence to a nonfarm residence is permitted in the farmland preservation district, provided the new lot is at least one acre and a special permit has been obtained.

Local Regulations and Tax Incremental Financing Districts

Figure 17 identifies local land use regulations and the number of designated tax incremental finance districts applicable within the study area. Understanding how land is regulated in each study community is important to gain insight into how land is planned to develop and where. It is also important to identify the location of tax incremental districts as these areas are slated for near-term development.

Neither Fond du Lac nor Sheboygan County administers countywide zoning, but both counties administer other countywide ordinances including subdivision, shoreland zoning, floodplain zoning, and erosion control and stormwater management.

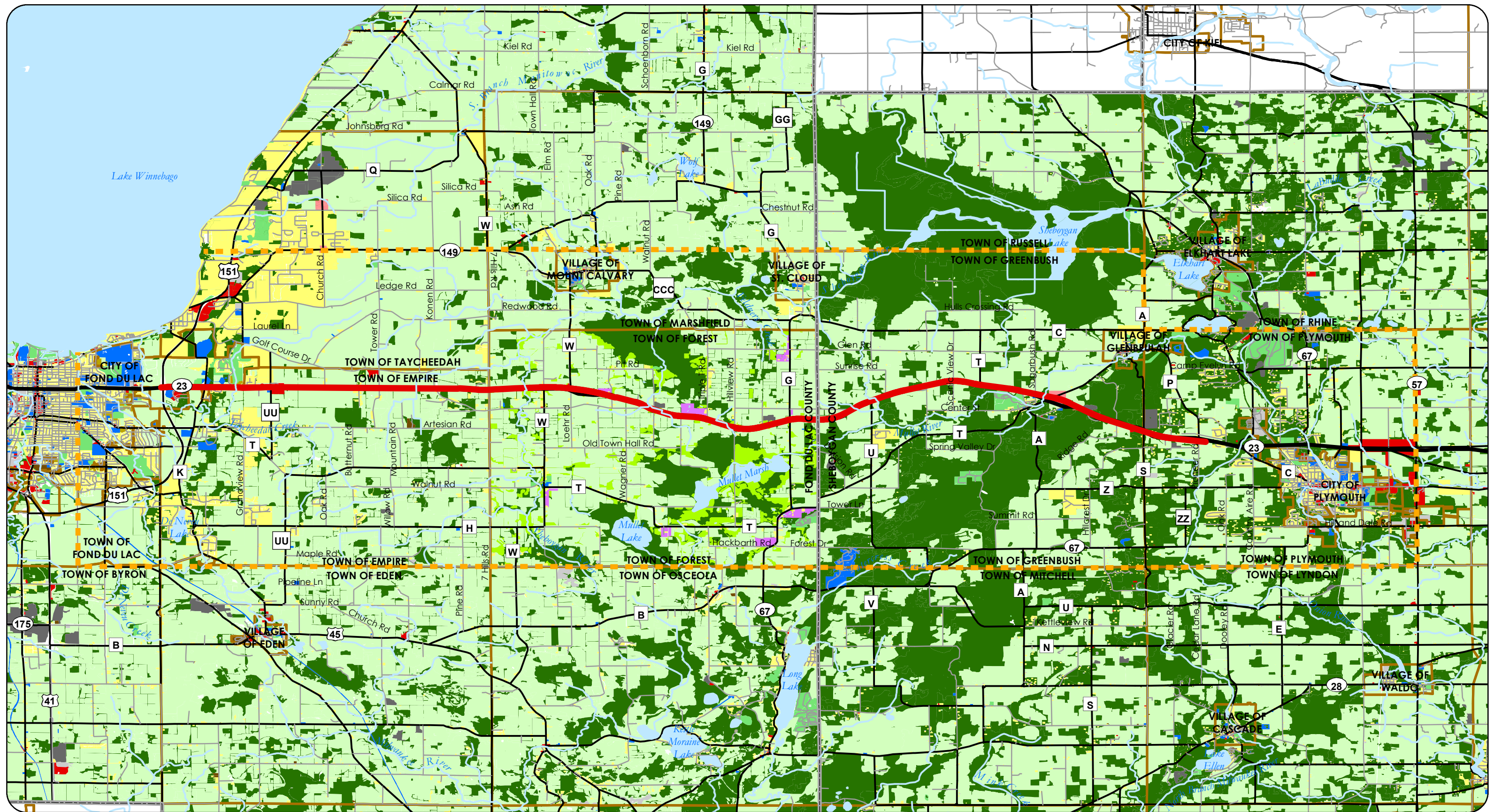
Figure 17: Land Regulations and Tax Incremental Financing (TIF) Districts

	Zoning Ordinance ¹	Land Division Ordinance ¹	Other Ordinances	Adopted Official Map ¹	Number of Active TIF Districts ²
City of Fond du Lac	City Zoning	Yes	Shoreland Zoning	Yes	6
City of Plymouth	City Zoning	Yes	Shoreland-Wetland Zoning	Yes	2
Town of Taycheedah	Town Zoning	Yes	Erosion Control and Stormwater Management	No	None
Town of Plymouth	Town Zoning	Yes	None	No	None
Town of Empire	Town Zoning	Yes	None	No	None
Town of Greenbush	Town Zoning	No	None	No	None
Town of Fond du Lac	Town Zoning	Yes	None	Yes	None
Town of Forest	Town Zoning	No	None	Yes	None
Town of Marshfield	Town Zoning	No	None	No	None
Village of Mt. Calvary	Village Zoning	Yes	None	No	None
Village of St. Cloud	Village Zoning	Yes	None	Yes	None
Village of Glenbeulah	Village Zoning	No	Shoreland Zoning	Yes	1
Fond du Lac County	None	Yes	<ul style="list-style-type: none"> • Shoreland Zoning • Flood Zoning • Erosion Control and Stormwater Management 	No	N/A
Sheboygan County	None	Yes	<ul style="list-style-type: none"> • Shoreland Zoning • Flood Zoning • Erosion Control and Stormwater Management 	No	N/A

Sources:

¹Wisconsin Department of Administration, 2011;

²Wisconsin Department of Revenue, 2011



WIS 23

Supplemental EIS

Map 9a: Future Land Use - Towns

Sources: Fond du Lac County, Sheboygan County, WIDNR, ECWRPC, US Census Bureau, Martensen and Eisele, Strand Associates, Vandewalle & Associates

0 0.5 1 2 Miles

4/1/2013



— WIS 23 Build Alternative

- - - WIS ICE 23 Study Area

— Major Road

— Local Road

— Surface Water

— County Boundary

— Municipal or Town Boundary

Future Land Use Categories

Single and Two Family Residential

Multi-Family Residential

Mobile Homes

Planned Neighborhood

Mixed Use

Future Development

Commercial

Industrial

Extraction

Institutional / Community Facility

Agriculture / Vacant

Open / Undeveloped

Public Open Space

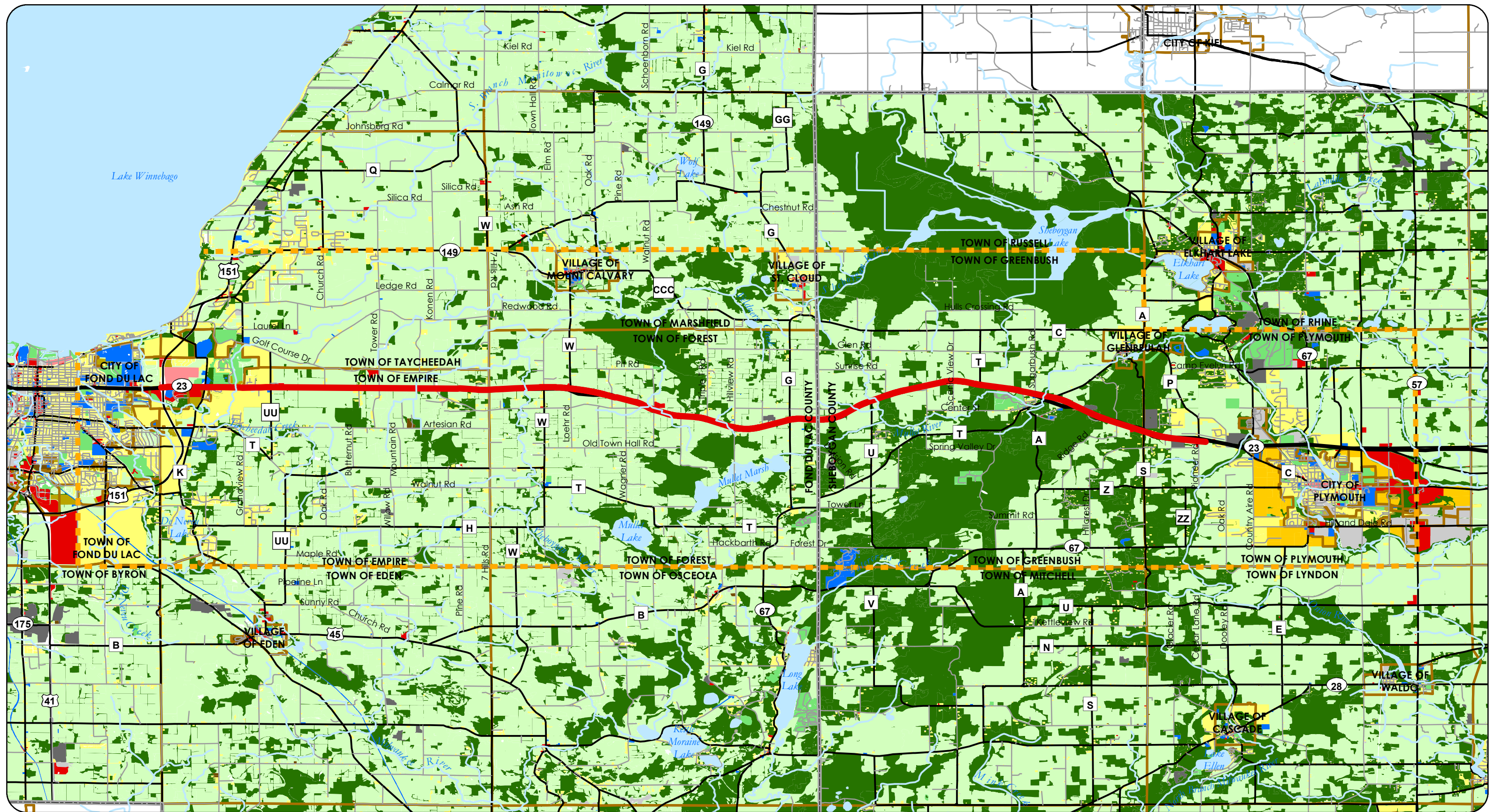
Woodlands/Environmental Corridor

Right-of-Way

Draft: February 24, 2014

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WIS 23 Supplemental EIS

Map 9b: Future Land Use - Cities and Villages

Sources: Fond du Lac County, Sheboygan County, WIDNR, ECWRPC, US Census Bureau, Martensen and Eisele, Strand Associates, Vandewalle & Associates

00.512 Miles

4/1/2013

WIS 23 Build Alternative

WIS ICE 23 Study Area

Major Road

Local Road

Surface Water

County Boundary

Municipal or Town Boundary

Single and Two Family Residential

Multi-Family Residential

Mobile Homes

Planned Neighborhood

Mixed Use

Commercial

Industrial

Extraction

Institutional / Community Facility

Agriculture / Vacant

Public Open Space

Woodlands/Environmental Corridor

Right-of-Way

Future Land Use Categories

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CHAPTER 3: INDIRECT EFFECTS ANALYSIS

The Council on Environmental Quality (CEQ) defines indirect effects as project impacts that are “caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable.” Indirect effects may include growth inducing or other effects related to changes in the pattern of land use, population density, or growth rate, and related effects on air and water and other natural systems, including ecosystems.

This indirect and effects analysis considers the two proposed alternatives—the No Build Alternative and the Build Alternative (4-lane expansion), which includes the corridor preservation alternative. Both alternatives and their potential indirect impacts are described in the following sections.

The study team collected and compiled an inventory of local and regional trend data, including: population and housing trends and projections; demographics, including environmental justice populations; income, labor force, industries, and commuting patterns; agricultural resources; natural resources; land use and development patterns; archaeological and historical resources; and local, county, regional, and state plans and regulations. These notable features were selected based on guidance from the WisDOT’s Guidance for Conducting an Indirect Effects Analysis as well as a determination by the study team that they were relevant to the analysis. This information has been compiled and is included in Chapter 2. Information from the inventory was considered in the preparation of this indirect effects analysis.

Counties and municipalities in the ICE study area have a long history of planning, zoning, and land division control. The study team and expert panel concur that locally adopted land use plans will be implemented because they are required to be adhered to based on Wis. Statutes 66.1001. These plans are in large part based on the assumption that historic, long-term population and employment growth trends, and resulting development markets, will continue in the future. These assumptions are corroborated by official population and household projections made by the Wisconsin Department of Administration (WisDOA) as directed by state statutes and generally produced every 5 years. The WisDOA’s approach for long range population and household projections, based on cohort survival and in and out migration patterns, has proven its merit and accuracy for many years. Therefore, it forms the basis for virtually all Wisconsin comprehensive plans adopted throughout the state for close to 3,000 counties and municipalities.

Expert panel members further confirmed that under the No Build Alternative, they expect development to occur per adopted comprehensive plans in terms of the amount, pace, location, type, and density of development. Expert panel members also indicated that similar impacts would occur under the Build Alternative, but would be slightly modified by changes in access, improved safety, and increased capacity as described in this chapter. The ICE study team corroborated the questionnaire completed by expert panel members at the expert panel meeting where maps indicating the location of impacts were also confirmed by the panel.

In addition to the very detailed knowledge of the expert panel, for this indirect and cumulative effects analysis, the study team read municipal plans, county plans, and local ordinances controlling development types, densities, and locations and reviewed WisDOA projections and actual US Census counts from 2010. The authors of this report have a combined 37 years of experience in local planning and development regulation, and knowledge of Wisconsin population and development trends and projections.

Throughout the course of this analysis, the ICE study team did not encounter issues or new information that would signal the need to vary from the long-term data, trends, or patterns identified by state, county, and local experts and as compiled, synthesized, and reported in this document. The ICE study team acknowledges that certain short-term trends, including population growth, building permits, economic conditions, and travel, do fluctuate in relation to national and global economies and markets, such as the recession of 2008. However, the ICE study team, as well as state and local experts, concur that over time such fluctuations have historically returned to long-term patterns, and are expected to do so in the future. This analysis forms the

basis of the ICE study team's conclusions behind the description of indirect and cumulative impacts throughout this report.

The theoretical foundation of many of the conclusions drawn in this impacts analysis is the Gravity Model of Social Interaction developed by William J. Reilly in 1931 from Reilly's Law of Retail Gravitation to calculate the breaking point between two places where customers will be drawn to one or another of two competing commercial centers. For decades, social scientists have been using Reilly's Law of Retail Gravitation (a modified version of Isaac Newton's Law of Gravitation) to predict movement of people, information, and commodities between cities and even continents. The 'Gravity Model', as social scientists refer to the modified law of gravitation, takes into account the population size of two places and their distance. Since larger places attract people, ideas, and commodities more than smaller places and places closer together have a greater attraction, the gravity model incorporates these two features.

The Gravity Model

$$\frac{\text{population}_1 \times \text{population}_2}{\text{distance}^2}$$

The relative strength of a bond between two places is determined by multiplying the population of city A by the population of city B and then dividing the product by the distance between the two cities squared. Some prefer to use the functional distance between cities instead of the actual distance. The functional distance can be the driving distance or can even be drive time between cities. Thus, the improvements under the Build Alternative, which increase capacity and thereby reduce driving time, will lead to greater interaction (more traffic) between places along the corridor and perhaps more dispersed development. The opinions of the expert panel and ICE study team are consistent with this broadly accepted theory.

Indirect Effects of No Build Alternative

The No Build Alternative would maintain the existing roadway in its current location and configuration. No improvements would be provided other than routine maintenance. The No Build Alternative serves as a baseline for comparison to the Build Alternative.

The following is a detailed analysis of the indirect effects of the No Build Alternative on traffic patterns, development, and resources.

Traffic Pattern

Figure 18 indicates that traffic volumes are projected to gradually increase on the WIS 23 corridor over the next 20+ years, which will increase congestion and travel time while decreasing system safety, particularly during times of peak travel. The WIS 23 intersection at County G was specifically identified by panelists as an area of significant safety concern and that the rate of traffic accidents at this intersection is expected to continue under the No Build Alternative. In addition, expert panelists identified, and the ICE study team agrees, the use of farm vehicles on the highway as an existing safety concern that will not be addressed and will continue under the No Build Alternative.

Figure 18: Existing and Forecasted Average Daily Traffic

Location WIS 23 Between:	Vehicles per Day (2012)	2035 Projections (No Build)
US 151/County K	10,800	15,700
County K/Whispering Spring Dr	9,500	11,000
Tower Rd/Poplar Rd	7,500	9,100
Hinn Rd/Loehr Rd	7,700	8,900
Triple T Rd/Hillview Rd	7,100	7,900
Division Rd/County U	6,400	7,200
Plank Rd/Sugarbush Rd	7,600	7,800
County S/County P	7,400	8,200
County P/Branch Rd	9,800	11,000

Source: WisDOT, Strand Associates.

The ICE study team believes that under the No Build Alternative, congestion may result in a portion of highway users altering their travel patterns, diverting some local highway traffic to local roads, particularly during peak travel periods. Such a shift would impact local roads in terms of increased traffic volumes, decreased safety, and higher maintenance costs.

Environmental Justice Populations

Environmental justice populations are described in Chapter 2 and depicted on Maps 2 – 5. Minority and low income populations are located at the ends of the ICE study area in the cities of Plymouth and Fond du Lac. Several census tracts in the ICE study area also have a greater proportion of elderly individuals (i.e. age 65+) when compared to county averages.

The study team determined that minority and low income populations will not be disproportionately adversely impacted by the No Build Alternative because generally employment and social services are available in Fond du Lac and Plymouth where such population concentrations occur and therefore travel on WIS 23 is generally not required. Conversely, elderly populations will be more adversely affected by increased congestion and decreased safety because they are concentrated in the central portion of the ICE study area and need to travel to the urban areas at the ends of the ICE study area for services.

General Development Pattern

Expert panelists and the ICE study team agreed that under the No Build Alternative, future land development within the WIS 23 study area will most likely occur in the locations planned for in adopted comprehensive plans (see Maps 9a and 9b). Panelists further indicated that the amount of land identified in comprehensive plans is adequate to accommodate future development, particularly in light of the current economic climate, which has substantially slowed land development in recent years.

Adopted comprehensive plans indicate that future development will primarily occur in undeveloped lands at the periphery of cities and villages. While the majority of outlying town lands are planned to remain as

agriculture, open space, or natural areas, the following areas are planned for future development in the vicinity of WIS 23:

- Residential and mixed use development at the south end of the town of Taycheedah, east of County UU.
- Highway commercial development at the intersection of County UU and WIS 23 in the town of Empire.
- Unspecified future development in the town of Forest on the north side of WIS 23, west of Triple T Road.
- Residential and commercial development in Greenbush at the intersection of County A and WIS 23, east of the Wade House historic site.
- Two areas of rural residential development in the town of Greenbush south of WIS 23 on either side of the Kettle Moraine State Forest.
- Commercial development along the WIS 23 frontage in the town of Plymouth, west of WIS 57 and east of the city of Plymouth.

Areas where panelists identified potential development that may occur under the No Build Alternative beyond that designated in adopted comprehensive plans are depicted on Map 10.

As is required under state statutes, local zoning supports development and preservation as indicated in adopted comprehensive plans. While certain areas have been planned and zoned for development in the study area, access to urban services and the real estate market will ultimately drive the pace, location, and intensity of future development.

Residential Development

Expert panelists and the ICE study team generally agreed that the location of future residential development will generally occur in locations planned by study area communities. As indicated in adopted comprehensive plans (see Maps 9a and 9b), new residential development in the study area is planned primarily in city and village growth areas, such as the east side of the city of Fond du Lac, the east and west sides of the city of Plymouth, and the north side of the village of Glenbeulah. Small areas of residential development are planned in the town of Greenbush and Empire, but otherwise very little new rural development is planned in study area towns, which is supported by farmland preservation zoning limiting lot sizes to between 10 to 35 acres.

Expert panelists identified areas where residential development may occur under the No Build Alternative on Map 10. These areas include lands in the town of Taycheedah to the east and northeast of Fond du Lac, along county highways on all sides of Mt. Cavalry, surrounding Wolf Lake in Marshfield, on the north and south side of St. Cloud, on the north side of Glenbeulah, east of the city of Plymouth near County S and County Z, and scattered residential development throughout the study area.

Expert panelists indicated, and the ICE study team agrees, that scattered, non-farm residential construction has occurred over the past couple of decades, which has reduced the amount of woodlands, natural areas, and farmland in the study area. Panelists suggested that low land prices and inadequate land use controls may have encouraged this trend. Recently adopted farmland preservation plans and zoning regulations, in combination with the slow economy and slowing population increases, will likely continue to reduce this trend. However, areas not protected by conservation or farmland preservation zoning may be at risk for long range future residential development if and when economic conditions improve.

Commercial Development

Expert panelists and the ICE study team generally agreed that the location of future commercial development will generally occur in locations planned by study area communities. As depicted on Map 9b, the city of

Plymouth plans for substantial commercial growth outside of the study area on its east side to the south of WIS 23 and adjacent to WIS 57. The city of Fond du Lac plans for future mixed-use development at the northeast quadrant of the WIS 23/US 151 interchange. As shown on Map 9a, the town of Forest anticipates a small area of commercial at the juncture of County G/County T, and the town of Plymouth anticipates commercial development along WIS 23 corridor to the northeast of the city of Plymouth.

Expert panelists and the ICE study team agreed that the timing of future commercial development will likely be tied to a broader economic recovery. Expert panelists and the ICE study team further agreed that increased traffic congestion and growing safety issues along the WIS 23 corridor may have a detrimental impact on future economic growth under the No Build Alternative, including the timing of future commercial development.

Some panelists identified a few areas of potential future small scale highway-oriented commercial development that are *not* planned by local communities (these are depicted on Map 10). These are located primarily at county highway intersections with WIS 23, as well as a large area of possible future commercial development on the southeast side of Fond du Lac where future residential development is now planned by the city.

Industrial Development

Very little industrial development is planned to occur in the study area. The city of Plymouth has identified industrial growth areas on the south side of the city in the study area and additional areas outside the study area (see Map 9b). Expert panelists and the ICE study team generally agreed that industrial development will likely occur in these locations under the No Build Alternative; however, as with commercial development, the timing of future industrial development will likely be tied to a broader economic recovery.

Expert panelists and the ICE study team further agreed that increased traffic congestion and growing safety issues along the WIS 23 corridor may have a detrimental impact on future industrial development under the No Build Alternative.

Institutional Development

Expert panelists indicated that Agnesian HealthCare recently announced that it will be opening a new hospital at the WIS 23/WIS 49 intersection in Ripon, approximately 25 miles west of the study area. This facility will provide healthcare services to a portion of the population in the study area. In addition the ICE study team notes that additional new small scale institutional development to serve local needs under the No Build Alternative is anticipated to occur as needed based on the pace of new residential development.

Redevelopment

As indicated previously, the present economic climate has substantially slowed land development and redevelopment in recent years. The ICE study team believes limited redevelopment is expected to occur in the study area under the No Build Alternative; however the timing of such redevelopment will likely be tied to a broader economic recovery.

Farmland

The majority of study area towns plan for the continuation of farming in existing agricultural areas. Farmland preservation plans prepared by Fond du Lac and Sheboygan counties aid in the preservation of productive farmland and protect farm operations from conflict with incompatible uses. However, the degree to which these plans are followed will vary depending on evolving growth policies and other land use regulations. The rate at which farmland is converted to non-agricultural uses will largely be a factor of economic conditions and each community's desire to preserve agriculture.

Expert panelists and the ICE study team generally agreed that only minimal farmland would likely be lost in the near term under the No Build Alternative beyond that associated with planned development in city and village growth areas. However, panelists indicated that in the longer term, agricultural land in the towns

adjacent to urban areas (i.e. Taycheedah, Plymouth, and Empire) may experience development pressure, particularly as the economy rebounds. Both near term and longer term impacts to farmland are expected to occur in locations consistent with those identified for development in local comprehensive plans.

In terms of property-specific impacts, it is the ICE study team's observation that because the decision to sell farmland for scattered rural residential development is often more related to personal circumstances and require only on-site well and septic systems, the precise timing and location of such development are very difficult to predict.

Wetlands

Wetland areas of regional significance are located in the study area. These include the Sheboygan River Marsh area, which has been identified by WDNR as a Land Legacy Place, Sheboygan Marsh County Park and State Wildlife Area, Kiel Marsh State Wildlife Area, Mullet Creek Wildlife Area, Mullet Lake State Natural Area, and Calvary Marsh. As indicated in the Land Legacy Report, protecting the open space around and between wetlands would buffer them from conflicting land uses and would link them together in an ecologically valuable corridor. Efforts in this general regard have been undertaken in Sheboygan County. Specifically, land conservancies have acquired 1,100 acres, which are protected by conservation easements. WDNR and land conservancies will likely continue to work to protect natural areas through land acquisition and conservation easements.

Expert panelists indicated, and the ICE study team agrees, that the amount of wetland areas lost to future development would be minimal under the No Build Alternative due to the minimal amount of new development. In terms of wetland quality, panelists suggested, and the ICE study team agrees, that the quality of wetlands in or adjacent to planned development areas may be minimally impacted by stormwater runoff from impervious surfaces associated with new development. Panelists noted that such impacts will likely accelerate over the long-term and as the economy rebounds, particularly surrounding the city of Plymouth. In addition, wetlands are strongly protected under federal and state law. Ultimately, the level of impact will vary based on development type, local regulations, mitigation activities, and future conservation efforts.

Surface and Ground Water

As indicated earlier in this report, the study area is located almost entirely within the Sheboygan River basin, which has been identified by the EPA as a Great Lakes Area of Concern (AOC). AOCs are geographic areas that are severely degraded, often due to water contamination from chemicals such as PCB's and heavy metals or excessive nutrient contributions. The main land uses and practices within the Sheboygan River basin that have contributed to adverse environmental conditions include agricultural and urban runoff, municipal and industrial discharges, wetland removal, and shoreline modification. In addition, as stated in the Niagara Escarpment Inventory of Findings Report, the Escarpment area is sensitive to groundwater contamination.

Panelists indicated that under the No Build Alternative, impacts to surface water levels and groundwater recharge areas are not anticipated beyond that associated with planned development in city and village growth areas and current trends in rural residential land development. Panelists did note, however, that stormwater runoff associated with new development, combined with higher traffic volumes and substantially more pollutants along the WIS 23 corridor, could result in increases in water pollutants. The level of impact will vary based on development type, local regulations, and mitigation activities. Overall, panelists concur and the ICE study team agrees that these impacts to surface water and groundwater are anticipated to be minimal under the No Build Alternative.

Air Quality

Motor vehicles contribute several pollutants listed in the National Ambient Air Quality Standards. These include:

- Nitrogen oxides that react with ammonia, moisture, and other compounds to form nitric acid vapor and related particles. These compounds can affect lung tissue.

- Volatile Organic Compounds (VOC) combine with oxides of nitrogen, react and create ozone. While beneficial in the upper atmosphere, ozone irritates the respiratory system at ground level. According to a 2005 EPA report, about 26 percent of VOCs come from on-road motor vehicles.
- Carbon Monoxide reduces the blood's ability to deliver oxygen to the body. Motor vehicle travel is the major contributor of Carbon monoxide in the United States.
- Particulate Matter (PM₁₀ and PM_{2.5}) produces ill health effect including asthma, lung cancers, and cardiovascular issues. According to a 2006 FHWA publication, motor vehicle travel contributed about 1 percent of PM₁₀ and 2 percent of all PM_{2.5} came from the exhaust of motor vehicles.

Other pollutants are also discussed in Section 4.6 of the LS SFEIS/ROD. With the No-Build Alternative, average daily traffic volumes on WIS 23 will increase 17 percent (weighted average) by the year 2035. Corresponding to the increased WIS 23 traffic volumes will be increased side road volumes that both feed WIS 23 and lead to destinations from WIS 23. Motor vehicle technology is improving which has been leading to a reduction in motor vehicle exhaust pollution. Even with emission decreases resulting from technology, increases in travel volumes will provide the opportunity for increased motor vehicle emissions and the resulting health consequences.

Expert panelists indicated, and the ICE study team agrees, that air quality would be impacted by increased emissions associated with congestion and with higher traffic volumes on the WIS 23 corridor under the No Build Alternative. Such emissions could further impact Sheboygan County's nonattainment status.

Woodlands and Ecologic Resources

The majority of woodlands in the study area are located within the Kettle Moraine State Forest–Northern Unit. The forest has been identified as an area of scenic and scientific value and is protected as a unit of the Ice Age National Scientific Reserve. Numerous areas with geographic features of scientific value are located within the study area but are not yet within or protected as part of the Ice Age National Scientific Reserve, including the interlobate moraine. These areas contain woodlands, wetlands, streams, grasslands, kettles, kames, and lakes.

A portion of the Niagara Escarpment is also located in the study area. Because of the distinctive geology of this natural feature, a number of unique plant and animal species rely on the integrity of the escarpment. As indicated in the Niagara Escarpment Inventory of Findings report, the escarpment's ecosystems have been threatened by development, not only in Wisconsin, but also in the upper peninsula of Michigan, New York, and Canada. The escarpment ridge is located just east of the city of Fond du Lac in an area that has been planned for long-term development (see Map 7a); therefore, a high degree of development pressure in the long-term may impact woodlands and ecological resources in the vicinity of the Niagara Escarpment.

Expert panel members and the ICE study team generally agreed that there will be minimal impact to woodlands under the No Build Alternative due to new development. Such development, particularly rural residential, could occur in woodlands or alter woodland and wildlife habitat areas. The ICE study team suggests the impact will mainly be due to additional rural residential development in areas planned and zoned for such. Impacts include habitat fragmentation and reduction of the natural aesthetic caused by residences and woodland clearing on the face or top of the Escarpment.

However, panel members noted that it is a goal of WDNR and Niagara Escarpment Network to acquire and preserve additional lands of scientific value. Expert panel members and the ICE study team generally agreed there may be negligible impacts woodlands that are within the planned expansion areas of the Kettle Moraine State Forest and the Niagara Escarpment under the No Build Alternative if these acquisition and preservation efforts are successful.

Glacial Features

There are numerous glacial features throughout the study area. One panel member noted that these features are not currently protected through local regulation. Expert panel members and the ICE study team generally

agreed there will likely be minimal impacts to glacial features under the No Build Alternative because there will be a limited amount of new development in areas where glacial features are present.

Endangered Species

Approximately 1/4 of the township and range sections in the study area have been identified as having occurrences of endangered species (see Map 7b). The majority are located in the towns of Forest and Greenbush. According to WDNR surveys, four threatened species may occur within the study area. These include the Slippershell Mussel, Ellipse Mussel, Butler's garter snake, and the Blanding's turtle.

Expert panelists indicated, and the ICE study team agrees, that the No Build Alternative is not expected to substantially impact these populations of endangered species due to absence of land-disturbing development activity indirectly related to the No Build Alternative.

Historic Resources

The No-Build Alternative is not expected to affect St. Mary's Springs Academy or the Sippel archeological site. Access to St. Mary's Springs Academy could become more problematic. Existing access to the Old Wade House site via WIS 23 currently poses traffic safety issues. Further, a new visitor center was constructed in 2012 and was designed to directly interface with an expansion of WIS 23 to 4 lanes. It is anticipated, and panelists agreed, that the Wade House historic site would be negatively impacted by growing traffic congestion and safety issues under the No-Build Alternative due to difficulty accessing the site. Impacts to historic resources are address more fully in the section 4.4 of the EIS.

Archaeological Resources

Known archaeological resources are protected from disturbance by state and federal regulations. Expert panel members did not identify archaeological resources and suggested that impacts to such resources would likely be minimal, if any, under the No Build Alternative. Undocumented archaeological resources are always at risk of being disturbed by development activity, however, the historically low development trends in the ICE study area are expected to continue under the No Build Alternative, likely having a low impact on these resources.

Trails

As described earlier in this report, the Old Plank Road Trail is a 17-mile multi-use trail that parallels WIS 23 from Sheboygan to Greenbush, linking with the Ice Age Trail in the Kettle Moraine State Forest – Northern Unit. Other trails in the study area include Ice Age Trail, the State Equestrian Trail, and a snowmobile trail—each of which directly cross WIS 23 between Plank Road and County S.

Expert panelists and the ICE study team agreed that impacts associated with the No-Build Alternative include continuation of the existing at-grade Ice Age Trail/State Equestrian Trail crossing on WIS 23, where high speed traffic is present, which many indicated they had experienced personally. Also, the proposed extension of the Old Plank Road Trail west to Fond du Lac would either be delayed, or would not occur, which panelists representing local governments indicated was something their constituents desired.

Community Character

Expert panelists and the ICE study team generally agreed that the No Build Alternative is not expected to significantly alter the existing character of study area communities, as development trends are likely to generally continue. These trends are likely to continue if ICE study area communities follow their adopted long range comprehensive plans which account for and are designed to accommodate modest continued growth. Small-scale highway-oriented commercial development may have a slight impact on rural character, as local zoning ordinances do not contain provisions that protect community character.

Indirect Effects of Build Alternative

The Build Alternative would expand the WIS 23 corridor from Plymouth to Fond du Lac to a 4-lane divided highway on the existing alignment. This alternative includes the following improvements:

- A roundabout at the intersection of WIS 23 and Wisconsin American Parkway.
- Interchanges and local roads near Fond du Lac, including County K, County UU, and County G.
- Extension of the Old Plank Road Trail, a multiuse trail that runs parallel to and south of WIS 23, from west of Greenbush to Fond du Lac.
- Access changes such as “right-in/right-out” and “left-in” at many local roads.
- Local road connections and extensions.
- Park and rides at County UU and County G.

In addition, the Build Alternative preserves right-of-way for long range future improvements including new interchanges with WIS 23 at County W and County A and new grade separations with WIS 23 at Tower Road, 7 Hill Road, Scenic View Drive, and Sugarbush Road.

The following is a detailed analysis of the indirect effects of the Build Alternative on traffic patterns, development, and resources.

Traffic Pattern

Expansion of WIS 23 to 4 travel lanes from Fond du Lac to Plymouth would increase overall system capacity, improve safety, and reduce regional travel time. Figure 19 indicates that traffic volumes on the WIS 23 corridor are projected to increase at a higher rate under the Build Alternative compared to the No Build Alternative.

Despite increases in traffic volume, the ICE study team anticipates that system improvements will decrease accident rates, reduce travel time, and improve travel predictability which may result in positive economic impacts—reduced travel time may promote residential growth in the study area, and access and visibility to a 4-lane highway may encourage some businesses to locate along or in the vicinity of the WIS 23 corridor. However, it should be noted that this is not an entirely new highway, which would have substantially more dramatic impacts on attracting development.

Expert panelists noted that the addition of the proposed WIS 23/County G interchange, in combination with safety improvements in this area, will result in fewer and less severe accidents and thus will ultimately result in fewer accident-related healthcare costs. On the other hand, expert panelists suggested that proposed J-turns at certain intersections may result in unsafe driving conditions for semis during inclement weather.

Figure 19: Existing and Forecasted Average Daily Traffic

Location WIS 23 Between:	Vehicles per Day (2012)	2035 Projections (No Build)	2035 Projections (Build Alternative)
US 151/County K	10,800	15,700	17,600
County K/Whispering Spring Dr	9,500	11,000	13,400
Tower Rd/Poplar Rd	7,500	9,100	11,200

Location WIS 23 Between:	Vehicles per Day (2012)	2035 Projections (No Build)	2035 Projections (Build Alternative)
Hinn Rd/Loehr Rd	7,700	8,900	10,800
Triple T Rd/Hillview Rd	7,100	7,900	9,500
Division Rd/County U	6,400	7,200	8,800
Plank Rd/Sugarbush Rd	7,600	7,800	9,300
County S/County P	7,400	8,200	9,600
County P/Branch Rd	9,800	11,000	12,700

Source: WisDOT and Strand Associates.

Environmental Justice Populations

Environmental justice populations are described in Chapter 2 and depicted on Maps 2 – 5. Minority and low income populations are located at the ends of the ICE study area in the cities of Plymouth and Fond du Lac. Several census tracts throughout the ICE study area also have a greater proportion of elderly individuals (i.e. age 65+) when compared to county averages.

The ICE study team determined that environmental justice populations will not be disproportionately adversely impacted by the Build Alternative. The most substantial changes to access in the Build Alternative occur in the town of Greenbush near the villages of Glenbeulah and Elkhart Lake. However, there are no concentrations of environmental justice populations in this area. A variety of less substantial access restrictions are proposed along other points in the corridor which may make access somewhat less convenient and trips slightly longer for the concentrations of elderly population in the central part of the ICE study area in the towns of Marshfield and Forest and the villages of Mount Calvary and St. Cloud. However, such access restrictions are likely to be offset by reduced highway congestion and safer conditions under the Build Alternative.

General Development Pattern

As with the No Build Alternative, expert panelists and the ICE study team agreed that future land development within the study area will generally follow adopted comprehensive plans (see Maps 9a and 9b). In the written questionnaire, there was some disagreement among panelists about the location, pace, and intensity of development that may occur under the Build Alternative as depicted on Maps 15 and 16. However, after discussing these impacts at the panel workshop meeting, expert panelists generally concurred with one another. Specifically, they identified development impacts that may occur within the jurisdiction they represent and deferred to other panelists for impacts in their communities.

It is the opinion of the expert panel and the ICE study team that the general locations of development at the western and eastern ends of the corridor will not be impacted under the Build Alternative because development in the cities of Fond du Lac and Plymouth respond to the provision of urban utilities and services. However, the pace of future development in these cities may be slightly accelerated as a result of reduced access along WIS 23 between the two cities pushing development to the ends of the corridor, where the preservation of access, reduced congestion, and improved ease of travel will attract development. The location, amount, and pace of future development in the rural central portion of the corridor (in the towns of Taycheedah, Forest, Greenbush, and Plymouth) may be further altered. Specifically, development will likely concentrate at future interchanges including County UU, County W (north), and County G, and be reduced where new access restrictions occur including Tower Road and 7 Hills Road. In the vicinity of Greenbush hamlet, interchange improvements at County T will likely be offset by access reductions at Sugarbush Road.

The ICE study teams believes that the pace and amount of growth related to the indirect effects of the Build Alternative will likely only be slightly higher than those associated with the No Build Alternative due to a combination of factors: regional growth trends have been and likely to continue to be modest, the Build Alternative is not a new highway facility but rather a modification of a long-existing highway, and the Build Alternative generally reduces the number of access points which has the strong tendency to focus additional development near remaining access points.

Residential Development

Expert panelists and the ICE study team generally agreed that residential development impacts will vary in the study area. For example, residential development may concentrate at higher densities in more urbanized areas and in other areas with highway access. Slightly shortened travel time for commuters and traveler comfort related to capacity and safety improvements may lead to slight increase in the amount of residential development in rural areas compared to the No Build Alternative. Smaller communities within the study area may experience modest increases in the pace and amount of residential growth as a result of improved access to major employment centers beyond the study area. Areas identified by panelists for possible residential development beyond areas identified in comprehensive plans are shown on Maps 15 through 17.

Other impacts associated with the Build Alternative include the direct access of rural residential lots to WIS 23 and response times of emergency vehicles. Expert panelists noted that a number of residential driveways presently have direct access to WIS 23. The Build Alternative will require alternate access and the potential relocation of driveway access to rural roads and county highways. Panelists also indicated that response times for emergency vehicles may be affected under the Build Alternative, particularly in the town of Greenbush. Higher response times could slightly reduce the amount of residential development in the study area. The WisDOT project manager indicated that access for emergency services would be coordinated in the design phase if the Build Alternative is implemented.

Commercial Development

Expert panel members and the ICE study team generally agreed that commercial development will continue to be focused in planned commercial areas under the Build Alternative, but unplanned highway-oriented commercial development may also occur at proposed interchange locations as a result of increased capacity and a focusing of access as proposed interchanges, combined with a general reduction of access in between interchanges. However, panelists noted and the ICE study team agrees that large increases in commercial development in rural areas, as well as large scale projects, are unlikely to occur until utilities and urban services are available in those areas. The ICE study teams notes that there are no plans for such provision of services at the time of writing.

In addition to the location of future commercial development, panelists indicated the Build Alternative may have the impacts in the study area listed below. This may be due to slight increases in traffic volume and commercial development under the Build Alternative.

- Higher-value commercial development may result.
- New economic development initiatives, such as marketing campaigns, creation of tax incremental financing districts, and new business parks and shopping centers may emerge.
- Employment related development may be channeled closer to WIS 23 and at higher concentrations.
- Communities with easier access to WIS 23 may experience greater economic growth than communities not directly on the corridor.
- Businesses may be encouraged to locate in the vicinity of WIS 23 corridor to take advantage of enhanced access and visibility.
- Connection of Sheboygan and Fond du Lac via a 4-lane highway may cause new economic development opportunities to emerge throughout the study area.

Industrial Development

Industrial development is primarily planned in the city of Plymouth on the south, southeast, and northwest sides of the city. Expansion of existing quarrying operations may also occur in the town of Plymouth as suggested by the town's comprehensive plan.

Expert panelists and the ICE study team generally agreed that the location of future industrial development will generally occur as planned under the Build Alternative, but at a somewhat accelerated pace and potentially at a somewhat greater intensity (e.g. more impervious surfaces) as a result of increased capacity and a focusing of access as proposed interchanges, combined with a general reduction of access in between interchanges. Panelists indicated that future industrial development may also be focused at interchange locations to take advantage of increased visibility. Panelists also suggested that new economic development initiatives may emerge, such as marketing campaigns, new tax incremental financing districts, and new industrial parks—such as in the city of Plymouth where industrial development is planned to occur.

Institutional Development

As suggested in the No Build Alternative, additional new locally serving institutional development in the study area is anticipated to occur as needed based on the pace of new residential development. However, compared to the No Build Alternative, institutional development may potentially occur at a somewhat faster rate under the Build Alternative when the economy recovers due to slight increases in the amount and pace of new residential development. Panelists also indicated that the intensity (e.g. more impervious surfaces) of new institutional development will likely be somewhat greater under the Build Alternative as a result of increased capacity and a focusing of access as proposed interchanges, combined with a general reduction of access in between interchanges.

Redevelopment

As indicated previously, the present economic climate has substantially slowed land development and redevelopment in recent years. Expert panelists and the ICE study team generally agree that limited redevelopment is expected to occur in the study area under the Build Alternative in the current economic climate; however, when the economy rebounds, redevelopment may occur at a slightly faster pace and at a slightly greater intensity/density under the Build Alternative as a result of increased capacity, reduced travel time, and reduced congestion. Redevelopment will most likely occur in urbanized areas, such as the cities of Fond du Lac and Plymouth.

Farmland

The majority of towns in the study area plan for the continuation of farming, except in small areas planned for development. County farmland preservation plans in combination with exclusive agricultural zoning further protect land that is planned to remain in agricultural uses and enables continuation of farming.

Expert panelists and the ICE study team agreed that the Build Alternative will likely slightly accelerate the pace of conversion of farmland compared to the No Build Alternative in areas planned for future development. The panel concurred that two counteracting trends would influence development at interchange locations. First, the development values of the land will likely increase providing an incentive for landowners to sell to developers. Second, town representatives and the WisDATCP representative on the panel also noted that agricultural commodity prices are very high which is providing an incentive to continue to farm. Areas of farmland not planned for development around interchange locations will likely experience development pressure and may result in the additional loss of farmland at these locations. As mentioned earlier, land development has been slow in recent years due to the slow economy; therefore, the degree to which land development is accelerated as a result of the highway expansion may be negligible until the economy makes a full recovery.

In addition, expert panelists noted a concern that closure of existing access to farm fields may result in the fragmentation of existing farms on opposite sides of the highway corridor. Fragmentation could lead to greater distances traveled by farm vehicles and may result in less productive and economically viable farm

operations. However, the WisDOT project manager indicated that farm field access will be maintained and unrestricted direct median crossovers will be included as part of the Build Alternative design which will be available for use by farm machinery, police and maintenance vehicles, and others.

Wetlands

As noted under the No Build Alternative, several wetland areas of regional significance are located in the study area, the protection of which is a priority for WDNR and local land conservancies. Expert panelists indicated, and the ICE study team agrees, that the amount of wetland areas lost to future development would be slightly increased under the Build Alternative compared to the No Build Alternative due to slight increases in the amount of new development. Wetlands are protected from development by state and federal regulations; therefore the ICE study team believes that substantial loss of wetlands is not anticipated under the Build Alternative. Where wetland areas are proposed to be filled for development, mitigation and/or replacement is required.

Panelists also noted that impacts resulting from increased pace and amount of development will likely accelerate over the long-term as the economy rebounds, particularly surrounding the city of Plymouth where substantial areas are proposed for development near wetland areas. Panelists also suggested that the quality of wetlands in or adjacent to planned development areas may be minimally impacted by stormwater runoff from impervious surfaces associated with new development. In addition, wetlands are strongly protected under federal and state law. Ultimately, the level of impact will vary based on development type, local regulations, mitigation activities, and future conservation efforts.

Surface and Ground Water

As indicated under the No Build Alternative, the study area is located almost entirely within the Sheboygan River Basin, which has been identified by the EPA as a Great Lakes Area of Concern (AOC). System improvements under the Build Alternative will increase the impervious surface area in the study area and the number of vehicles using the corridor. These factors may contribute to increases in the peak rate and volume of stormwater runoff and pollutants, including chloride, salt, and other deicing chemicals. In addition, as stated in the Niagara Escarpment Inventory of Findings Report, the Escarpment area is sensitive to groundwater contamination.

Expert panelists indicated, and the ICE study team agrees, that increased stormwater runoff and land development under the Build Alternative may reduce the area available for groundwater recharge which may alter surface water levels and further reduce water quality through increased sedimentation and increased temperature, particularly after periods of heavy rain and/or snow melt. However, panelists indicated, and the ICE study team agrees, the degree of these impacts would likely be slightly higher compared to the No Build Alternative.

One member of the expert panel indicated that the marshes in the study area receive much of the runoff in this corridor. There will be an increased impact to the marshes in the study area under the Build Alternative due to increased impervious surface area and new development.

Air Quality

As mentioned under the No Build alternative, motor vehicles contribute several pollutants listed in the National Ambient Air Quality Standards that affect human health. These pollutants include nitrogen oxides, volatile organic compounds which lead to ozone, carbon monoxide, and minor amounts of particulate matter. Other pollutants are also discussed in Section 4.6 of the LS SDEIS.

With the Build Alternative, 2035 average daily traffic volumes on WIS 23 would be 17 percent (weighted average) greater than the traffic volumes associated with the No Build Alternative. Corresponding to the higher WIS 23 traffic volumes would be higher side road traffic volumes. Increases in traffic volumes over what would normally occur with the No Build alternative will provide the opportunity for increased motor vehicle emissions and the resulting health consequences. Expert panelists had varying opinions on air quality impacts for the study area under the Build Alternative. Panelists indicated that increased traffic volume might decrease air quality.

due to increased traffic capacity and volumes, while others suggested that system improvements permitting free flow travel conditions would improve air quality due to less stop and go driving, while others suggested air quality impacts would be negligible.

Woodland and Ecologic Resources

The majority of large tracts of woodlands in the study area are located in the Kettle Moraine State Forest – Northern Unit. As described earlier, the Forest is protected as a unit of the Ice Age National Scientific Reserve. Numerous other areas containing geographic features of scientific value, including the interlobate moraine, are located within the study area but are not yet within or protected by an Ice Age National Scientific Reserve.

As described earlier, the Niagara Escarpment is located in the study area. Hydrologic disruption and outright destruction of some of Escarpment features due to road construction is identified as a current threat in the Niagara Escarpment Inventory of Findings report. The report also indicates that residential development is one of the most pressing threats to the Niagara Escarpment as past residential development and associated infrastructure has also fragmented sensitive habitats and may destroy rare plant and animal species.

Expert panel members and the ICE study team generally agreed that there will be slightly increased impacts to woodlands under the Build Alternative compared to the No Build Alternative as a result of slightly increased pace and amount of development. Such development, particularly rural residential, could occur in woodlands or alter woodland and wildlife habitat areas. Panelists also indicated that invasive species, such as phragmites, spread rapidly along highway corridors, which is another possible impact of the Build Alternative. Expert panelists indicated that the Build Alternative could further impact the Escarpment, unique glacial features, and other resources areas of ecological significance. The ICE study team suggests the impact will mainly be due to additional rural residential development in areas planned and zoned for such. Impacts include habitat fragmentation and related impacts on threatened and endangered species, and reduction of the natural aesthetic caused by residences and woodland clearing on the face or top of the Escarpment.

However, panel members noted that it is a goal of WDNR and Niagara Escarpment Network to acquire and preserve additional lands of scientific value. Expert panel members and the ICE study team generally agreed there may be minimal impacts to woodlands that are within the planned expansion areas of the Kettle Moraine State Forest and the Niagara Escarpment under the Build Alternative if these acquisition and preservation efforts are successful.

Glacial Features

There are numerous glacial features throughout the study area. One panel member noted that these features are not currently protected through local regulation. Expert panel members and the ICE study team generally agreed there will likely be slightly increased impacts to glacial features under the Build Alternative due to lack of protection (e.g., overlay zoning) and slightly increased amounts of new development compared to the No Build Alternative. These impacts would be reduced if the WDNR implements its plans to acquire 7,000 acres of new land around the Kettle Moraine State Forest.

Threatened and Endangered Species

Approximately ¼ of the township and range sections in the study area have been identified as having occurrences of endangered species (see Map 7b). The majority are located in the towns of Forest and Greenbush. According to WDNR surveys, four threatened species may occur within the study area. These include the Slippershell Mussel, Ellipse Mussel, Butler's garter snake, and the Blanding's turtle. Panelists indicated, and the ICE study team agrees, that reduction and degradation of habitat as a result of slightly increased pace and amount of development under the Build Alternative could further threaten or potentially cause the displacement or loss of these threatened species.

Historic Resources

As indicated previously, the Wade House is a noteworthy historic site in the study area located on the WIS 23 corridor. Expert panelists indicated, and the ICE study team agrees, that the Wade House would be positively

impacted by the Build Alternative as the planned visitor center and carriage house museum are designed to interface with an expansion to WIS 23 and associated improvements which will assure safe access to the site. Further, panelists indicated that the site would benefit from improved visibility and access for both cars and bicycles. Impacts to historic resources are addressed more fully in the section 4.4 of the EIS.

Archaeological Resources

As indicated under the No Build Alternative, archaeological resources are protected from disturbance by state and federal regulations. Expert panel members did not identify any specific archaeological resources that may be impacted under the Build Alternative; however, potential loss of undiscovered archaeological sites was noted as a potential impact of the Build Alternative. The ICE study team suggests new development indirectly related to the Build Alternative would require ground-disturbing activities. These activities could adversely impact unknown archaeological sites, and since archaeological reconnaissance is not required for private development, these sites would not be avoided. Since the amount of new development under the Build Alternative is likely to be slightly greater compared to the No Build, the likelihood of adversely impacting unknown archaeological sites would be slightly higher.

Trails

The Ice Age Trail and a horse and a snowmobile trail currently cross WIS 23 between Plank Road and County S. As part of the expansion project, an underpass will be constructed to provide a safer crossing across WIS 23 and to ensure these important recreational corridors are not interrupted. The WisDOT project manager noted that proposed park and rides in the Build Alternative could also include trailheads.

Expert panelists indicated, and the ICE study team agrees, that the extension of the Old Plank Road Trail from Plymouth to Fond du Lac will be a very positive impact of the Build Alternative. As proposed under the Build Alternative, the Old Plank Road Trail will connect with the 7-mile Prairie Trail in Fond du Lac, which is part of a larger system of trails to link the Peebles Trail and the Wild Goose Trail in Dodge County. Panelists also indicated the Build Alternative will result in safer and more efficient access to trails which will provide economic benefits for communities with trail access. While the trail network is anticipated to be improved in the study area, expert panel members, and the ICE study team, do not anticipate new land development associated with the expanded trail network.

The Niagara Escarpment Network is in the process of developing a Niagara Escarpment Greenway Plan, which will include a future north-south hiking trail along the escarpment that will cross the WIS 23 corridor. Extension of the Old Plank Road Trail under the Build Alternative would connect with this and other future trails, improving the regional trail network.

Community Character

Expert panelists and the ICE study team generally agreed that the Build Alternative is not expected to significantly alter the existing character of study area communities, as development trends are likely to be only slightly increased compared to the No Build Alternative. These trends are likely to continue if ICE study area communities follow their adopted long range comprehensive plans which account for and are designed to accommodate modest continued growth trends. However, some panelists indicated the rural character of the towns may be affected by accelerated growth of nearby cities and villages. Others suggested that easier access provided by WIS 23 may increase demand for “country-living” under the Build Alternative, and the increased development could negatively affect rural character in such areas. Finally, near future rural interchanges small-scale highway-oriented commercial development may also have a slight impact on rural character, as local zoning ordinances do not contain provisions that protect community character.

Panelists and the ICE study team generally agreed that community character will ultimately be dependent upon local government regulation and the quality of development and siting decision. Panelists also indicated that the Build Alternative will not increase the number of billboards in the study area due to lack of demand for off-site advertising. The ICE study team notes that adopting regulations that prevent billboards would be a more certain way of avoiding this adverse impact on community character.

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CHAPTER 4: CUMULATIVE EFFECTS ANALYSIS

The Council on Environmental Quality (CEQ) defines a cumulative impact as “the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.”

Scoping for the Cumulative Effects Analysis

See Chapter 2: Inventory of the Study Area for significant issues associated with the proposed action.

The ICE study area for this cumulative effects analysis encompasses the same area used for the indirect effects analysis (see Map 1). Land use planners on the study team interacted with staff planners from Fond du Lac County, Sheboygan County, and East Central Wisconsin Planning Commission to determine the likely range of influence from the WIS 23 corridor. Beyond the study area, the influence of WIS 23 diminishes as other arterial corridors provide access to adjacent lands.

The timeframe for this cumulative effects analysis is 20 years which corresponds with the planning horizon of the majority of local comprehensive plans; however, it can be assumed that the effects identified in this analysis would continue to be valid after 20 years if local policies and regulations remain the same.

Past, Present, and Future Actions and Influences

Major roadway projects that have recently occurred in the study area include the US 151 Fond du Lac bypass on the south side of the city (constructed in 2005-2008) and the expansion of WIS 23 to 4-lanes from US 151 easterly to County K in Fond du Lac County and the expansion of WIS 23 to 4-lanes from Plymouth to Sheboygan in Sheboygan. At the time of writing, the following WisDOT studies were being conducted in the vicinity of the project study area:

- The WIS 23 Corridor Preservation Study. This study is considering alternatives to convert a 10 mile section of the WIS 23 corridor between County P and WIS 32 to a freeway in order to provide greater safety and mobility. This study will determine where land acquisitions for frontage roads, overpasses, and interchanges may be necessary for such freeway conversion. No construction is planned as a part of this study. Implementation of the improvements will occur as determined by future operational needs.
- The US 151 Fond du Lac Bypass Corridor Preservation Study. This study is addressing future, long-term transportation needs of two segments of the US 151 Fond du Lac bypass between WIS 175 and County WH. The first segment is a 5.2 mile 4-lane divided expressway between WIS 175 and WIS 23. The preservation study will map the right-of-way needs for the location of future overpasses and interchanges. WisDOT's long-term vision of this segment is an ultimate freeway with increased mobility and traveler safety. The second segment is a 2.9 mile 2-lane highway between WIS 23 and County WH. Right-of-way was previously acquired along this segment to accommodate a future four-lane segment. The preservation study for this segment includes a long-term safety and operations evaluation. It is likely three projects will be implemented from this study before the year 2020. These projects include the County V interchange with US 151, the County T overpass over US 151, and improvements to the DuCharme Parkway/US 151 intersection.
- US 41 Conversion Study. In 2005, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) identified US 41 from Milwaukee to Green Bay as a high priority corridor based on its importance for providing regional, national and international freight

and vehicle movements. The Act also identified this section of US 41 as a future interstate highway. WisDOT, in consultation with FHWA, is studying potential impacts of converting US 41 from a non-interstate freeway on the National Highway System to an Interstate Highway between the Zoo Interchange on Interstate 94 (I-94/I-894) in Milwaukee and the US 41/I-43 interchange in Green Bay. The 132-mile corridor extends through portions of Milwaukee, Waukesha, Washington, Dodge, Fond du Lac, Winnebago, Outagamie, and Brown counties. A portion of the corridor is aligned with US 45 from the Zoo Interchange to the US 45/41 split in Washington County. New I-41 signage would extend from I-43 in Green Bay to the Zoo Interchange, then would be concurrent with I-894 around the southwest side of Milwaukee, and then would be concurrent with I-94 south to just beyond the Illinois State line at the interchange of I-94 and US 41.

The past, present, and future actions and plans of other agencies are described in greater detail in Chapter 2: Inventory of the Study Area. In addition, the activities of other entities have affected the study area. For example, local land use policies and decisions have led to the conversion of farmland and woodlands for scattered residential and nonresidential development over the past decades. To counter this trend, local regulations have changed over the past 10 years, including farmland preservation planning, zoning, and the acquisition of conservation easements have protected natural areas from future development. Other past activities, such as agricultural practices, urbanization, and stream channelization, have impacted the quality of waterways in the study area. However, modern agricultural practices, wetland mitigation banking and environmental cleanup of impaired waters, such as the Sheboygan River, have helped to improve conditions in the study area.

As indicated in Chapter 3, agencies have planned for future land conservation through acquisition in the study area and beyond, in particular expansion of the Kettle Moraine State Forest. At the same time, expert panelists suggested that commodity prices are currently high and are expected to continue to increase, which raises the value of agricultural land. This, in turn, may affect agencies' ability to acquire additional land for conservation purposes. This increase in commodity prices may also drive some farmers to convert wooded areas to tillable land causing additional impacts on natural resources through runoff and habitat loss. These trends are not influenced by the WIS 23 project.

The pace and amount of residential and non-residential development that may occur as a result of the No-Build and Build Alternatives is tied to market demand resulting from a combination of demographic factors and economic conditions. The country is emerging from an economic recession, which has slowed market demand in recent years. This is illustrated by residential building permits issued in Fond du Lac and Sheboygan Counties (see Figure 20). The number of residential building permits in Sheboygan and Fond du Lac Counties is considerably lower in 2011 than in 2006.

Figure 20: Annual New Privately Owned Residential Building Permits, Estimates with Imputation

	2006	2007	2008	2009	2010	2011
Sheboygan County	318	237	135	89	67	56
Fond du Lac County	334	255	172	128	125	101

Source: US Census

While it is difficult to project the number of future residential building permits based on recent trends and obvious effects of the recession and uncertainty regarding the timing of the economic recovery, the Wisconsin Department of Administration does provide long-term household projections for all municipalities and counties in the state. Figure 21 shows total household projections (existing plus new households) for study area communities and counties. As indicated below, the study area is expected to see increases in the number of households, primarily in the city of Fond du Lac. The villages of Mt. Calvary, St. Cloud, and

Glenbeulah and the towns of Marshfield and Forest are projected to only see modest increases in the number of households by 2030.

Figure 21: Household Projections (2010-2030)

	2010	2015	2020	2025	2030	# Change 2015-2030	% Change 2015-2030
Town of Fond du Lac	1,014	1,055	1,092	1,122	1,144	130	12.8%
Town of Empire	1,045	1,100	1,153	1,198	1,236	191	18.3%
Town of Taycheedah	1,539	1,634	1,724	1,803	1,872	333	21.6%
Town of Forest	432	445	458	467	473	41	9.5%
Town of Marshfield	397	405	410	413	413	16	4.0%
Village of Mt. Calvary	225	242	259	274	288	63	28.0%
Village of St. Cloud	199	204	207	210	211	12	6.0%
City of Fond du Lac	18,398	19,332	20,199	20,946	21,569	3,171	17.2%
Fond du Lac County Portion of Study Area	23,249	24,417	25,502	26,433	27,206	3,957	17.0%
Town of Greenbush	576	616	654	691	727	151	26.2%
Town of Plymouth	1,208	1,263	1,316	1,368	1,413	205	17.0%
Village of Glenbeulah	179	188	198	207	214	35	19.6%
City of Plymouth	3,744	4,008	4,270	4,527	4,767	1,023	27.3%
Sheboygan County Portion of Study Area	5,707	6,075	6,438	6,793	7,121	1,414	24.8%
Study Area Total	28,956	30,492	31,940	33,226	34,327	5,371	18.5%
Fond du Lac County	41,036	42,933	44,692	46,164	47,362	6,326	15.4%
Sheboygan County	47,310	49,304	51,241	53,092	54,718	7,408	15.7%

Source: Wisconsin Department of Administration, 2015-2030 Housing Projects, 2008.

Based on its demographic, land use, and economic development expertise, and as confirmed by the ICE expert panel, the study team believes that the market demand for new development is likely to return to pre-recession trends as the economy rebounds. However, reduced overall projections by WDOA may dampen this effect.

The activities of other entities have affected the ICE study area. Local land use policies and decisions have led to the conversion of farmland and woodlands for scattered residential and nonresidential development over the past decades. Figure 22 compares farm data from the 2007 and 2002 Census of Agriculture.

Figure 22: Agriculture Trends

	2002 Fond du Lac County	2007 Fond du Lac County	2002 Sheboygan County	2007 Sheboygan County
Number of Farms	1634	1643	1116	1059
Land in Farms (acres)	344,286	335,745	195,248	191,719
Average Farm Size (acres)	211	204	175	181
Total Cropland (acres)	292,255	279,922	166,592	157,607

Source: Census of Agriculture

Incremental development in the ICE study area has also impacted natural resources, particularly the Niagara Escarpment, which is located in the ICE study area (the escarpment brow extends north-south along the eastern periphery of the city of Fond du Lac), and the Kettle Moraine State Forest, which intersects with WIS 23 in the town of Greenbush.

In 2008 the Blue Sky Green Field Wind Energy Center was constructed in Fond du Lac County, Wisconsin. The 10,600-acre wind farm is located in the towns of Calumet and Marshfield in northeast Fond du Lac County and is the largest operating wind farm in Wisconsin.

The Affected Environment

The study team collected and compiled an inventory of local and regional trend data, including: population and housing trends and projections; demographics including environmental justice populations; income, labor force, industries, and commuting patterns; agricultural resources; natural resources; land use and development patterns; archaeological and historical resources; and local, county, regional, and state plans and regulations. See Chapter 2: Inventory of the Study Area and Section 3 of the LS SDEIS for a characterization of resources in the ICE study area.

Stresses Affecting Resources, Ecosystems, and Human Communities

The anticipated levels of stress under both alternatives are virtually identical to each other and to what has historically occurred.

- **Agricultural land:** Market forces affect how much land is in agriculture and which crops are grown, which is a function of population growth, local plans, and zoning controls. Once converted to development, agricultural land will likely never return to agricultural use. The result is a consistent long-term trend in the reduction of agricultural lands. However, unlike rapidly urbanizing areas of Wisconsin (e.g., Green Bay/Fox Valley, Dane County, and the Milwaukee metro areas), the ICE study area remains healthy in terms of agricultural infrastructure and support services.

- **Wetlands:** The majority of historic and ongoing wetland losses in the ICE study area have resulted mostly from farming and conversion of small wetlands which are not protected under local, state, or federal regulations. Wetland ecosystems are very sensitive to change from disruption of native ground cover as a result of farming or development activity. Ongoing significant adverse impacts result from chemical application from farming or lawn care and increased impervious surfaces within their watershed.
- **Water quality:** Water quality is sensitive to change from disturbing the native ground cover as a result of farming or development activity and resulting increases in sedimentation. Ongoing significant adverse impacts also result from chemical application from farming or lawn care and increased impervious surfaces within their watershed.
- **Upland habitat:** Market forces affect how much land is in development and where it is located, which is a function of population growth, local plans, and zoning controls. Local plans and zoning rarely protect these areas. However, in the ICE study area, substantial upland areas are located in the Kettle Moraine State Forest, which enjoy permanent protection. Once converted to development, upland habitat will likely never return to undeveloped natural area.
- **Threatened and endangered species:** The three freshwater mussels that may be potentially directly affected by the Preferred Alternative are likely the most susceptible rare species on the project corridor. Their response to change is poor as related to draining, encroachment of habitat, loss of water quality buffers, and water pollution. Fifty-four percent of all mussels in Wisconsin are listed as rare species. Siltation from all mechanisms, including agriculture and roadway runoff, causes loss of aquatic bed habitat for these species. Water chemistry through increased fertilizer and agricultural use, stormwater runoff, and residential development has also affected these species.

Threatened reptilian species such as the Blanding's turtle and the Butler's garter snake are documented to have stable populations and found to be present in greater extent and density than previously thought throughout the ICE study area. Many impacts to these species result from concentrating beneficial habitats and loss of riparian buffers along streams. Natural succession from the exclusion of fire and reduced forestry management is reducing suitable, open upland habitat needed for many additional species. Increased runoff results in wetland sedimentation that often alters and degrades native plant communities, favoring monotypic stands of nuisance or exotic species not beneficial to these species. Roads have also fragmented habitats and resulted in altered hydrology and mortality for some species.

Migratory-rare woodland-nesting birds and red-shouldered hawk populations in this part of Wisconsin are generally considered stable based on the woodland habitat in and near the Kettle Moraine Forest. Destruction of wintering and breeding habitat through deforestation and rural home development continue to present a large threat. Other limiting factors include forest fragmentation, contaminants, loss of key tree species to diseases, cowbird parasitism, and human disturbance. Invasive shrubs and herbaceous plants could be affecting the long-term ability of forests to regenerate into conditions suitable for some of these species and is precluding regeneration of large, mature trees in various woodland communities.

Rare plants are the final listed species of concern. The yellow gentian is a candidate for delisting. It has proven to be capable of tolerating change and disturbance and has expanded its presence in suitable habitat types. The snow trillium is a more sensitive listed species in the project. Being a near-climax species, it has low tolerance for change and stress. Wetland clearing and grading of mature, wooded riparian habitat may have a further effect on this species. Continued suburban development, riparian clearing and filling, increased flooding, rural habitat loss and fragmentation from woodland home sites, invasive shrubs and herbaceous plants, and loss or harvest of large, mature trees in oak woodlands diminish the habitat for snow trillium.

- Historic and archeological resources: No information is readily available regarding the response to change and capacity to withstand stress for these resources.
- Air quality: Information regarding the response to change and capacity to withstand stress for air quality is addressed in section 4 of the EIS.
- Trails: The two trails in the ICE study area vary in their purpose and character. The Ice Age Trail is intended to provide access to the kettle moraine formations in a manner that highlights glacial landforms. To best meet this objective the natural landscape should be as free from development as possible. Therefore, increasing development diminishes the experience of the resource. The Old Plank Trail is intended to provide a recreational experience along the route historically linking Sheboygan to Fond du Lac. For this reason the trail corridor is very close to WIS 23 and adjacent developed areas. Future development will likely occur near the WIS 23 corridor, however, the study team notes that such development is not inconsistent with the recreation purpose and character of this trail.
- Environmental justice populations: Environmental justice populations have a lower ability to respond to change and capacity to withstand stress related to age, income, education, general health, and access to health care.

Figure 23 summarizes stresses and factors that are affecting resources.

Figure 23: Stresses Affecting Resources

Resource	Stresses and Factors Affecting Resource
Agricultural Land	Development and urbanization High commodity prices
Wetlands	Urban and agricultural runoff Point source discharges Runoff from roads
Water Quality	Urban and agricultural runoff Stream channelization and erosion Point source discharges Runoff from roads
Upland Habitat:	Development and urbanization High commodity prices encourages land clearing for agriculture
Northern Unit of Kettle Moraine State Forest	High land prices decrease ability to acquire remaining tracts of land. Built environment, including road and agricultural runoff, diminish resources within State Forest.
Niagara Escarpment	Development and urbanization Wind turbines increase fragmentation of natural resources
Threatened and Endangered	Diminished water quality in streams and wetlands.

Figure 23: Stresses Affecting Resources

Resource	Stresses and Factors Affecting Resource
Species	Reduction in upland habitat caused by urbanization and agriculture
Historic and Archeological Resources	Property modifications and changes in the surrounding area can diminish historic value. Construction activities can disturb unrecorded archeological sites.
Trails	Funding constraints may prevent trail extensions and enhancements
Environmental Justice Populations	Gentrification can increase housing costs. Economic conditions affect employment opportunities.

Population growth, future development, sewer service extensions, transportation and other infrastructure improvements, and agricultural practices could continue to impact wetlands, water quality, upland habitats, and wildlife in the ICE study area. Agricultural land may also be lost because of increasing urbanization in the ICE study area, but rising commodity prices may stem this trend.

The baseline conditions for the purposes of this cumulative effects analysis are predicted based on information provided by local land use plans, county, regional, and state plans, United State Geological Survey data, WDNR data, WDOA population data and reports generally described in this cumulative effects analysis.

Determining the Environmental Consequences

Cause and Effect Relationships

The WIS 23 Build Alternatives will directly affect land uses and resources. Land that will be purchased for right of way will decrease the amount of cropland, upland habitat, and housing. The WIS 23 Build Alternatives will also indirectly affect land uses and resources by promoting more efficient and safe travel between the Fond du Lac metropolitan area and the Sheboygan metropolitan area. As described in the indirect effect analysis, this project has the potential to accelerate the timing of future development in the ICE study area. Where access has been restricted and focused by the construction of new interchanges, the project will also likely focus the location of development.

Additional development in the ICE study area may lead to a loss in agricultural land and will further encroach on and fragment natural habitats such as wetlands and woodlands. Habitat loss may also threaten rare sensitive species. Development will also generate additional stormwater runoff, which will impact water quality in the region and the previously identified rare species.

It should be noted, however, that modest historic employment, population, and general development trends are expected to continue to be consistent with adopted comprehensive plans and WisDOA population projections. Expert panelists and the ICE study team concur that the ICE study area and the surrounding area has historically been and is expected to remain an area of modest growth, in contrast to the northern portion of Calumet County or the West Bend area.

Cumulative Impacts of the No Build Alternative

The No Build Alternative would maintain the existing roadway in its current location and configuration. No improvements would be provided other than routine maintenance.

These notable features were selected based on guidance from the WisDOT's Guidance for Conducting an Indirect Effects Analysis as well as a determination by the study team that they were relevant to the analysis. This information has been compiled and is included in Chapter 2. Information from the inventory was considered in the preparation of this cumulative effects analysis.

This section describes the estimated magnitude of the cumulative effects of the No Build Alternative based on input from the expert panel and the study team's expertise.

Traffic Patterns

Traffic volumes will continue to increase over time as forecasted and as a result of long-term regional population growth. There will be cumulative impacts on traffic patterns under the No Build Alternative because of diminishing system safety associated with long-term increased traffic volume and limited capacity. The ICE study team notes that the proposed US 151 Fond du Lac Bypass project, which would decrease travel times around the south and east sides of Fond du Lac and ties into WIS 23 at the west end of the corridor, and the conversion of US 41 to an interstate, may lead to increased regional traffic on WIS 23 due to reduced travel times.

Environmental Justice Populations

There are no direct impacts to environmental justice populations under the No Build Alternative. In terms of indirect impacts, the study team determined that concentrations of minority and low-income populations will not be disproportionately adversely impacted by the No Build Alternative because generally employment and social services are available in Fond du Lac and Plymouth where such population concentrations occur and therefore travel on WIS 23 is generally not required. Conversely, concentrations of elderly populations will be more adversely affected where they are concentrated in the central portion of the ICE study area and need to travel to the urban areas at the ends of the ICE study area for services.

In terms of cumulative impacts, in the long-term, the percentage of elderly populations is projected to increase in the coming decades based on data from the Wisconsin Department of Administration Demographic Services. The lack of improvements under the No Build Alternative will not address safety problems currently found in the corridor. This safety issue may disproportionately impact elderly residents and drivers who are more at risk where safety problems exist. As a result, these safety problems under the No Build Alternative are likely to slightly adversely impact a larger percentage of the population within the ICE study area as well as a larger percentage of drivers traveling on WIS 23 in the future.

Other cumulative effects of the No Build Alternative will be minimal and may include:

- *Need for additional public and non-motorized vehicle transportation.* The availability of public and non-motorized vehicle transportation options (i.e. sidewalks, bike lanes, paths, and trails) varies throughout the study area, with metro areas having a greater abundance of such options. As new development occurs, additional transportation options may be needed to provide multiple transportation options beyond the single occupancy vehicle. Transportation options will be helpful for all individuals in the ICE study area to reach new employment destinations.
- *Need for safe, affordable housing in vicinity of employment destinations.* The need for new, safe, affordable housing will likely continue. In Fond du Lac and Plymouth, higher density housing is planned near locations planned for employment. Future development of these areas may fill the need to provide affordable housing in the ICE study area.

General Development Pattern

The ICE study area has experienced modest change in land use patterns in the past two decades. The majority of the ICE study area is rural and much of it remains in agricultural use. Over the years, some unsewered residential development has occurred in most of the towns in the study area. Most concentrated development has occurred within and around cities and villages located in the study area—primarily in the cities of Fond du Lac and Plymouth, and to a much lesser extent the village of Mount Calvary, Glenbeulah, and St. Cloud. Some industrial development has occurred in the cities of Fond du Lac and Plymouth and some highway-oriented commercial development is very sparsely scattered along the WIS 23 corridor.

As indicated in Chapters 2 and 3, under the No Build Alternative, future land development within the ICE study area will most likely occur in the locations planned for in adopted comprehensive plans. The ICE study team believes cumulative effects to development under the No Build Alternative will be minimal based on no changes to WIS 23, the continuation of steady long-term trends for modest development, lack of major regional transportation improvements and other large scale development projects, and the continued long-term economic viability of agricultural activities which reduces the likelihood of land conversion for other development.

Farmland

Population growth and past development decisions have led to incremental loss of farmland in the ICE study area. As indicated in Chapter 3, the incremental loss of farmland in the ICE study area over the long-term is a possible indirect effect under the No Build Alternative. As expressed by the expert panelists and indicated in local land use plans, this trend will continue. As the economy makes a recovery, other factors that will lead to a loss of farmland include modest exurban residential development and the aging agricultural workforce. According to the US Agricultural Census, Fond du Lac and Sheboygan counties lost 8,985 acres of farmland between 2002 and 2007. The amount of agricultural land required for the WIS 23 Preferred Build Alternative represents 2.5 percent of this 5-year loss.

However, local land use plans and zoning and farmland preservation policies indicate a strong desire by most communities in the study area to preserve agricultural lands by directing development to areas adjacent to cities and villages where it can be served by sewer and water and generally be developed at higher densities, thereby reducing the acreage needed to accommodate development. The cumulative effect on farmland under the No Build Alternative will be minimal based on modest long-term development trends and the continued long-term economic viability of agricultural activities, which reduces the likelihood of land conversion for other development.

Wetlands

Wetlands are scattered throughout the area with large concentrations primarily located in the towns of Forest, Marshfield, and Greenbush, which are mostly permanently protected through public ownership. The incremental filling of wetlands elsewhere has occurred over time as a result of development. The conversion of wetlands to agricultural uses has also occurred over time. However, a comparison of pre-European settlement and current land cover data indicates that approximately 98 percent of historic wetlands remain in the study area due to public acquisition of large wetlands in the Sheboygan Marsh and the Mullet Marsh areas. As indicated in Chapter 3, there will likely be minimal indirect impacts to wetlands in the study area under the No Build Alternative. The cumulative effects on wetlands under the No Build Alternative will be minimal since there are no direct impacts, and because many of the larger concentrations of remaining study area wetlands are located on state-managed lands or are otherwise subject to state and federal wetland regulations and are therefore protected from development and actively managed. Impacts would consist mainly of continued wetland quality effects created by salt and debris from the existing roadway and future development activity.

Surface Water and Groundwater

The quality of surface water and groundwater in the study area has been impacted over the years by urban and agricultural land use practices and pollutants associated with chemical storage, road salt, accidental spills, leaking underground storage tanks, leaking underground pipes and sewers, animal feed lots, fertilizers, septic tanks, sewage lagoons, sumps and dry wells, and improperly abandoned wells.

As noted in Chapter 3, overall, indirect impacts to surface water and groundwater are anticipated to be minimal under the No Build Alternative. However, other future transportation projects in the region and increases in development may affect water quality and will likely contribute to incremental increases in the amount of urban runoff that enters and is distributed throughout the basin due to increased impervious surfaces. Alternatively, future public acquisition or private preservation of natural areas in the study area may help improve water quality by keeping lands undeveloped.

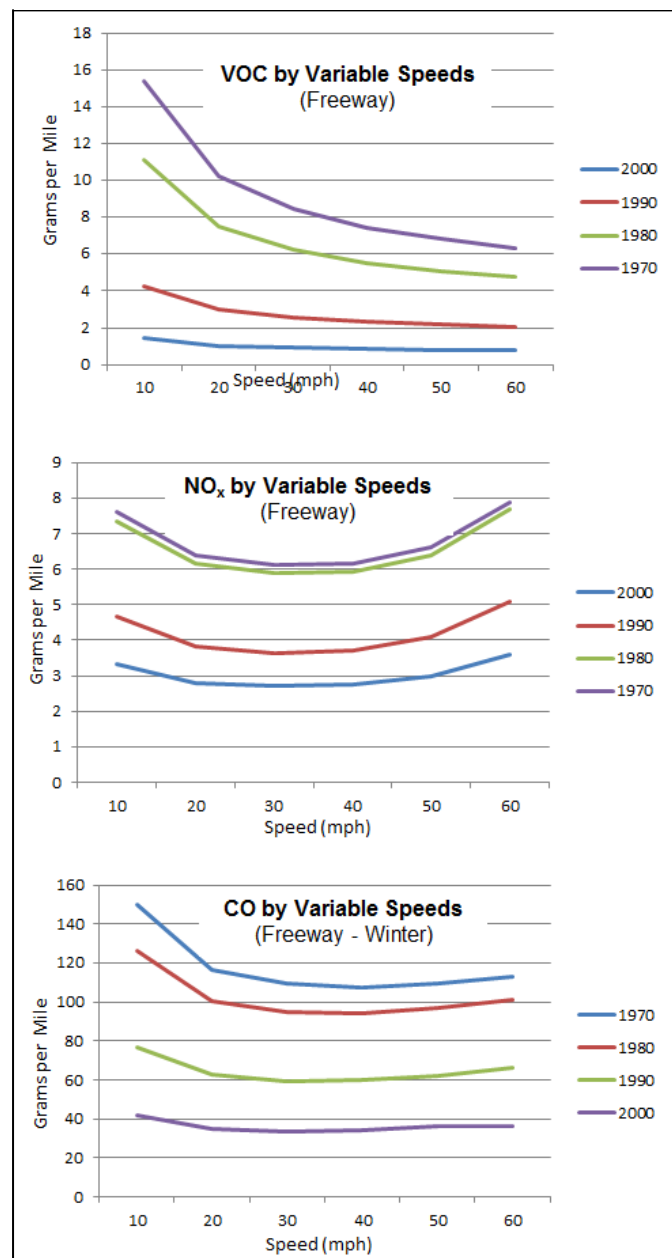
The cumulative effect on surface water and groundwater under the No Build Alternative will be minimal based on modest development trends, current economic conditions, and potential preservation and mitigation activities.

Air Quality

As indicated in Chapter 3, reduction in air quality is a potential indirect impact under the No Build Alternative as a result of increased traffic volume and congestion on the WIS 23 corridor. As described in Chapter 2, Sheboygan County is an EPA designated nonattainment area for the 8-hour NAAQS for ozone. However, according to the 8-Hour Ozone Redesignation Request and Maintenance Plan report, WDNR has actively been monitoring and implementing programs designed to control emissions of volatile organic compounds (VOCs) and ozone (NO_x) which have contributed to significant air quality improvements. WDNR commits to continue monitoring ozone levels in Sheboygan County indefinitely and has requested attainment status by EPA. WDNR actions as well as the actions of other agencies and entities contribute to air quality impacts, including transportation projects.

The 17 percent (weighted average) WIS 23 traffic volume increase that is forecast to occur between 2012 and 2035 with the No Build Alternative has the potential to increase vehicle emissions. That combined with increases in vehicle miles traveled throughout Fond du Lac and Sheboygan Counties may lead to increases in exhaust pollutants that could be partially offset by technology advances.

Figure 24: Emission vs. Speed



As mentioned previously, NO_x and VOC emissions are a precursor to the formation of ozone, and Sheboygan County is not in attainment for the 8-hour standard for ground-level ozone (Fond du Lac County is in attainment.) The impact-causing effects of the Build Alternative on these emissions is complicated. Figure 24 shows emission graphs for VOCs and NO_x emissions versus speed. Emission rates vary based on the speed a vehicle is traveling. US EPA's model for highway vehicle emissions - MOBILE 6.2³ - shows how speed affects emissions rates. VOC and CO emissions rates typically drop as speed increases. NO_x emission rates increase at higher speeds. Emissions rates at all speeds have been falling over time as newer, more controlled vehicles enter the fleet.⁴

The No-Build Alternative will have lower traffic volumes and lower travel speeds. Generally this means that traffic from the No-Build Alternative could produce higher VOC emissions and lower NO_x emissions per each vehicle traveling on the roadway. The 17 percent (weighted average) WIS 23 traffic volume increase that is forecast to occur between 2012 and 2035 with the No-Build Alternative will increase the number of vehicles on the roadway, potentially increasing vehicle emissions. That combined with increases in vehicle miles traveled throughout Fond du Lac and Sheboygan counties may lead to increases in exhaust pollutants that could be partially offset by technology advances. The projected 2020 daily summer traffic on the Sheboygan County portion of WIS 23 represents about 2.39 percent of the total vehicle miles traveled (VMT) in Sheboygan County for a summer day.⁵

Woodlands and Ecologic Resources

A comparison of pre-European settlement and current land cover data indicates that approximately 55 percent of historic forested lands remain in the study area—a significant portion of this is the Kettle Moraine State Forest. As described in Chapter 2, WDNR plans to acquire approximately 7,000 acres of new land, conduct restoration activities, and improve management practices to protect wildlife and enhance recreation. In addition, WDNR recently partnered with the Hardwood Forestry Fund, a 501(c)(3) foundation that establishes sustainable forests for future generations. The foundation received a grant in 2011 from the American Forest's Global ReLeaf program to plant 20,800 trees on 20 acres of the Kettle Moraine State Forest – Northern Unit near Plymouth. The planting efforts will aid in reduction of the forest fragmentation, allowing for more contiguous native hardwood forests. Additional benefits include production of woody biomass, carbon sequestration, the improvement of habitat for forest interior wildlife species, and the increased opportunity for forest-based recreational opportunities.

As indicated in Chapter 3, there will likely be modest indirect impacts to woodlands under the No Build Alternative. Cumulative impacts will be minimal under the No Build Alternative because long-term development in the region as a result of modest population growth will lead to minimal conversion of woodlands over time. However, the decisions and actions of state agencies and other environmental organizations, such as those described above, may contribute to reducing negative impacts to woodlands over the next 20 years and likely beyond through purchase and permanent protection of lands with woodlands as called for in plans for the Escarpment and Kettle Moraine.

The Niagara Escarpment Report documents the biodiversity associated with the escarpment and lists recommended strategies to ensure long-term integrity of this natural feature. However, many areas of the escarpment continue to see steady population growth and increases in development pressure, including most recently by the development of wind farms along the ridge. In 2011, the Bay-Lake Regional Planning

³ US EPA has a new air quality model called MOVES, however air quality modeling for Sheboygan County was performed using the previous model Mobile 6.2)

⁴ http://www.fhwa.dot.gov/environment/air_quality/publications/fact_book/page15alt2.cfm June 2013

⁵ Based on the Table C-5 in Appendix C, the conformity analysis for the Sheboygan MPO TIP for the 2013 to 2016 Calendar Years.

Only Sheboygan County is referenced because it is not in attainment. Fond du Lac County is in attainment.

Commission prepared a Niagara Escarpment Overlay Zoning Guide to help Wisconsin communities delineate, develop, implement, and enforce overlay zoning to protect the escarpment.

As indicated in Chapters 2 and 3 there will likely be minimal indirect impacts to the escarpment resulting from the No Build Alternative. Cumulative impacts to the Escarpment and ecological resources will be minimal under the No Build Alternative because modest long-term development in the region as a result of modest population growth will lead to residential development which may disrupt Escarpment features. However, activities of local communities along the escarpment and state agencies could result in positive cumulative impacts. For example, efforts to purchase conservation easements and implement overlay zoning could permanently protect the Escarpment thereby avoiding impacts.

Glacial Features

There are numerous glacial features throughout the study area. One panel member noted that these features are not currently protected through local regulation. As indicated in Chapter 3, there will likely be minimal indirect impacts to glacial features resulting from the No Build Alternative due to lack of protection (e.g., overlay zoning) and modest amounts of new development. These impacts would be reduced if the WDNR implements its plans to acquire 7,000 of new land around the Kettle Moraine State Forest. Cumulative effects to glacial features under the No Build Alternative will be minimal based on no changes to WIS 23, lack of other major regional transportation improvements, and the continuation of steady long-term trends for modest development which is the main threat to disruption of glacial features.

Threatened and Endangered Species

As described in Chapter 2, the following threatened species exist in the study area: Slippershell Mussel, Ellipse Mussel, Butler's garter snake, and the Blanding's turtle. It is difficult to estimate the pre-settlement populations of threatened and endangered species except by gauging changes in their habitat. The current amount of Wisconsin waters acreages and stream threads is comparable to the amount that existing in pre-settlement conditions; however, the water quality has diminished, which has likely resulted in decreased mussel populations. The current forested acres in the state and the study area has also declined since pre-settlement conditions, which may contribute to fragmentation and reduced quality of wildlife habitat, including that of the garter snake and turtles. Similarly, wooded species and the introduction of exotic/invasive species into open canopy wetlands and grasslands has decreased suitable habitat for wildlife.

As indicated in Chapter 3, there will likely be minimal indirect impacts to threatened and endangered species under the No Build Alternative. Similarly, there may be minimal cumulative impacts under the No Build Alternative given the modest regional population growth and related development pressure on habitat areas (e.g. woodland and wetlands), lack of other major regional transportation improvements, and no direct impacts associated with highway construction.

Historic and Archaeological Resources

The most noteworthy historic site in the study area is the Wade House. As described in Chapter 3, existing safety issues and traffic congestion will continue under the No Build Alternative. There may be cumulative impacts on the Wade House historic site including a minor reduction in the number of visitors. There will be limited cumulative impacts on other historic resources under the No Build Alternative since there are no directed and minimal indirect impacts.

Archaeological resources are protected from disturbance by state and federal regulations; therefore indirect and cumulative impacts associated with the No Build Alternative are anticipated to be negligible, if any.

Trails

State, county, and local governments and other organizations in the study area continually plan for the acquisition and development of new trails, as described in Chapter 2. As described in Chapter 3, the potential indirect impacts to trails include delay of extension of the Old Plank Road Trail west to Fond du Lac and delay of construction of underpass for safe passage across WIS 23 for the Ice Age Trail and snowmobiles. In

terms of cumulative impacts, as traffic congestion and trail usership increases over time, the presence of unsolved safety concerns and gap in the Old Plank Road trail network resulting from the No Build Alternative will become more problematic.

Community Character

The existing character in the study area is both urban and rural, depending on the location along the corridor. Farmland and unique natural features, such as the Niagara Escarpment, Kettle Moraine State Forest, and the many glacial features in the study area help to define rural areas. As indicated in Chapter 3, the No Build Alternative is expected to have minimal indirect impacts in the study area.

There will be modest cumulative impacts on community character under the No Build Alternative because the development activities that cause impacts will be modest and related to local government planning and zoning decisions and general economic conditions. In general, as small town and rural areas experience development, their community character is threatened by both the amount and ubiquitous suburban nature of new development. Area communities currently do not strongly address community character in their adopted plans or in their development regulations. Rural communities that have these regulations in place generally have protected small town and rural character more successfully.

Cumulative Impacts of the Build Alternative

The Build Alternative would expand the WIS 23 corridor from Plymouth to Fond du Lac to a 4-lane divided highway on the existing alignment. The following is a detailed analysis of the cumulative impacts of the Build Alternative compared to the baseline conditions described under the No Build Alternative on traffic patterns, development, and resources.

These notable features were selected based on guidance from the WisDOT's Guidance for Conducting an Indirect Effects Analysis as well as a determination by the study team that they were relevant to the analysis. This information has been compiled and is included in Chapter 2. Information from the inventory was considered in the preparation of this cumulative effects analysis.

This section describes the estimated magnitude of the cumulative effects of the Build Alternative based on input from the expert panel and the study team's expertise.

Environmental Justice Populations

There are no direct impacts to environmental justice populations under the Build Alternative. Indirect impacts under the Build Alternative may include access restrictions that are proposed along points in the corridor, which may make access somewhat less convenient and trips slightly longer for the concentrations of elderly population in the central part of the ICE study area in the towns of Marshfield and Forest and the villages of Mount Calvary and St. Cloud. However, such access restrictions are likely to be offset by reduced highway congestion and safer conditions under the Build Alternative.

In terms of cumulative impacts, in the long-term, the percentage of elderly populations is projected to increase in the coming decades based on data from the Wisconsin Department of Administration Demographic Services. The improvements under the Build Alternative will address safety problems currently found in the corridor and thus correct a problem, which disproportionately impacts elderly residents and drivers who are more at risk where safety problems exist. Other cumulative effects of the Build Alternative will be modest and may include:

- *Need for additional public and non-motorized vehicle transportation.* The availability of public and non-motorized vehicle transportation options (i.e. sidewalks, bike lanes, paths, and trails) varies throughout the study area, with metro areas having a greater abundance of such options. As new development occurs, additional transportation options may be needed to provide multiple transportation options beyond the

single occupancy vehicle. Transportation options will be helpful for all individuals in the ICE study area to reach new employment destinations.

- *Need for safe, affordable housing in vicinity of employment destinations.* Similarly, as modest new employment related growth occurs as a result of the Build Alternative, the need for new, safe, affordable housing will likely occur. In Fond du Lac and Plymouth, higher density housing is planned near locations planned for employment. Future development of these areas may fill the need to provide affordable housing in the ICE study area.

Traffic Patterns

Expansion of WIS 23 to 4-travel lanes from Fond du Lac to Plymouth would increase overall system capacity, improve safety, and reduce regional travel time. Travel forecasts indicate that a 4-lane expansion would increase daily traffic by 15 to 24 percent, depending on the segment over the No Build Alternative. It is anticipated that these system improvements will decrease accident rates and simplify commutes which may result in positive economic impacts—simpler commutes may promote residential growth in the study area and access and visibility to a 4-lane highway may encourage businesses to locate along or in the vicinity of the WIS 23 corridor. In addition, the Build Alternative will facilitate easier east-west movement across the east-central portion of the state. The ICE study team notes that the proposed US 151 Fond du Lac Bypass project, which would decrease travel times around the south and east sides of Fond du Lac and ties into WIS 23 at the west end of the corridor, and the potential future conversion of US 41 to an interstate, may lead to increased regional traffic on WIS 23 due to reduced travel times. There will be positive impacts on traffic patterns under the Build Alternative due to more efficient and safe travel between the Fond du Lac metropolitan area and the Sheboygan metropolitan area.

General Development Pattern

Future land development in the study area will generally follow adopted comprehensive plans. As described in Chapter 3, the Build Alternative has the potential to concentrate development at access points and accelerate the pace of future development in the study area. In general, the expert panel and the ICE study team agreed that the main indirect effect of the Build Alternative is creation of a modest demand for more development, primarily located at the ends of the study area.

The panelists generally agreed that long-term economic conditions and local government planning and zoning policies, combined with the access control elements of the Build Alternative, would strongly influence the *location* of development. However, the panelists also agreed that long-term economic conditions and local policies are more influential on the *amount and type* of development than the improvements associated with the Build Alternative. While certain areas have been planned and zoned for development in the study area, access to urban services, local government planning and zoning decisions, and general economic conditions will ultimately drive the pace, location, and intensity of future development.

In terms of cumulative impacts, there may be slightly increased amount and pace of development under the Build Alternative based on development trends and economic conditions.

The ICE study team believes there will generally be slightly increased cumulative effects to development under the Build Alternative compared to the No Build Alternative. These effects will be based on improved transportation connections between Fond du Lac and Sheboygan moderated by the continuation of steady long-term trends for modest development, lack of numerous major regional transportation improvements and large scale development projects, and the continued long-term economic viability of agricultural activities which reduces the likelihood of land conversion for other development. However, a particular location-specific impact can be identified. Specifically, the US 151 Fond du Lac Bypass project in combination with improvements proposed to WIS 23 under the Build Alternative will likely result in additional and faster commercial development around the US 151/WIS 23 interchange and surrounding areas. Such additional commercial development will likely result in additional employment and associated residential development.

This residential development is likely to be a combination of both nearby urban housing and more scattered rural residential housing. In all instances, such induced development will likely be consistent with adopted comprehensive plans. The ICE study team believes that the Build Alternative will not induce significant regional development because the proposed improvements are part of a long-established highway rather than a new corridor. Within the region similar impacts have been observed along US 151, US 41, and I-43.

Farmland

Population growth and past development decisions have led the incremental loss of farmland in the study area. The construction of the Build Alternative would directly require 227 acres of farmland. According to the US Agricultural Census, Fond du Lac and Sheboygan counties lost 8,985 acres of farmland between 2002 and 2007. The amount of agricultural land required for the WIS 23 Preferred Build Alternative represents 2.5 percent of this total. Also, as indicated in Chapter 3, expert panelists agreed that the Build Alternative will likely slightly accelerate the conversion of farmland in areas planned for future development, and an overall increase in urbanization may increase development pressure in rural areas.

As mentioned earlier, land development has been slow in recent years due to the slow economy; therefore, the degree to which land development is accelerated as a result of the highway expansion may be negligible until the economy makes a full recovery. In terms of cumulative impacts, when the economy makes a recovery, other factors that will contribute to slightly increased levels of farmland conversion include regional exurban residential development, commodity prices, and the aging agricultural workforce. Local government planning and zoning decisions and general economic conditions will influence the impacts.

Wetland

Wetlands are scattered throughout the area with large concentrations primarily located in the towns of Forest, Marshfield, and Greenbush, which are mostly permanently protected through public ownership.

The construction of the Build Alternative will directly require 48.1 acres of wetlands. According to WDNR records using aerial photography, there are about 109,600 acres of wetlands in Fond du Lac and Sheboygan Counties. Wetlands filled by the Build Alternative will be mitigated at a wetland mitigation bank site near the corridor. Also, as indicated in Chapter 3, panelists indicated that additional impervious surfaces associated with the roadway expansion and new development will increase stormwater runoff and reduce the quality and ecological integrity of wetland areas, including wetlands of regional significance.

In terms of cumulative impacts to wetlands, incremental filling of wetlands in the region has occurred over time as a result of development. The conversion of wetlands to agricultural uses has also occurred over time. However, a comparison of pre-European settlement and current land cover data indicates that approximately 98 percent of historic wetlands remain in the study area. The cumulative effects on wetlands under the Build Alternative will be slightly increased compared to the No Build Alternative based on slightly increased regional development pressure and other regional transportation projects. Impacts would consist mainly of continued water quality effects created by salt and debris from the existing roadway and slightly increased impervious surfaces.

Surface Water and Groundwater

The construction of the Build Alternative will add more than 90 acres of impervious surface. Also, as noted in Chapter 3, expert panelists and the ICE study team indicated that increased stormwater runoff and land development under the Build Alternative may impact soils for groundwater recharge and may alter surface water levels, particularly after periods of heavy rain and/or snow melt. However, panelists indicated the degree of these impacts to be minimal; this may be because the Build Alternative would be constructed on-alignment rather than establishing a new route. Over time, the increased traffic and development under the Build Alternative will likely contribute to incremental increases in the amount of urban runoff that enters and is distributed throughout the Sheboygan River basin. As indicated in Chapter 2, Lake Winnebago and De Neveu Creek are designated as Section 303(d) water resources; they may be at a higher risk for impacts.

One member of the expert panel indicated that the marshes in the study area receive much of the runoff in this corridor. There will be an increased impact to the marshes in the study area under the Build Alternative due to increased impervious surface area and new development. The WisDOT project manager indicated that best management practices will be employed during construction of the highway to minimize erosion and runoff.

The quality of surface water and groundwater in the study area has been impacted over the years by urban and agricultural land use practices and pollutants associated with chemical storage, road salt, accidental spills, leaking underground storage tanks, leaking underground pipes and sewers, animal feed lots, fertilizers, septic tanks, sewage lagoons, sumps and dry wells, and improperly abandoned wells.

There may be slightly increased cumulative impacts on surface water and groundwater under the Build Alternative compared to the No Build Alternative due to increased impervious surface from this and other regional transportation projects, slightly increased regional development pressure, and other impacts described above.

Air Quality

As indicated in Chapter 3, reduction in air quality is a potential indirect impact under the No Build Alternative as a result of increased traffic volume and congestion on the WIS 23 corridor. As described in Chapter 2, Sheboygan County is an EPA designated nonattainment area for the 8-hour NAAQS for ozone. However, according to the 8-Hour Ozone Redesignation Request and Maintenance Plan report, WDNR has actively been monitoring and implementing programs designed to control emissions of volatile organic compounds (VOCs) and ozone (NOx) which have contributed to significant air quality improvements. WDNR commits to continue monitoring ozone levels in Sheboygan County indefinitely and has requested attainment status by EPA. WDNR actions as well as the actions of other agencies and entities contribute to air quality impacts, including transportation projects.

The Build Alternative will lead to 2035 daily traffic volumes that are 17 percent (weighted average) higher than what would normally occur with the No Build alternative. The emissions associated with these higher traffic volumes, combined with other human activities such as manufacturing, off road vehicles, and other sources could lead to continued high ozone levels in Sheboygan County.

As mentioned previously, NOx and VOC emissions are a precursor to the formation of ozone, and Sheboygan County is not in attainment for the 8-hour standard for ground-level ozone (Fond du Lac County is in attainment.) The impact-causing effects of the Build Alternative on these emissions is complicated. Figure 24 shows emission graphs for VOCs and NOx emissions versus speed. Emission rates vary based on the speed a vehicle is traveling. US EPA's model for highway vehicle emissions - MOBILE 6.2⁶ - shows how speed affects emissions rates. VOC and CO emissions rates typically drop as speed increases. NOx emission rates increase at higher speeds. Emissions rates at all speeds have been falling over time as newer, more controlled vehicles enter the fleet.⁷

The Preferred Build Alternative will have higher traffic volumes and higher travel speeds. Generally this means that traffic from the Preferred Build Alternative could produce marginally lower VOC emissions and higher NOx emissions. Additionally, the projected 2035 daily traffic volumes are 17 percent (weighted average) higher than what would normally occur with the No-Build alternative. The projected 2020 daily summer traffic on the Sheboygan County portion of WIS 23 represents about 2.52 percent of the total vehicle miles traveled in Sheboygan County for a summer day. With the Preferred Build Alternative, WIS 23 has 0.13 percent more VMT contribution to the total county VMT. The emissions associated with these higher traffic volumes

⁶ US EPA has a new air quality model called MOVES, however air quality modeling for Sheboygan County was performed using the previous model Mobile 6.2)

⁷ http://www.fhwa.dot.gov/environment/air_quality/publications/fact_book/page15alt2.cfm June 2013

combined with other human activities such as manufacturing, off-road vehicles, and other sources emit VOCs and NO_x that contribute to ground-level ozone levels in Sheboygan County.

As mentioned, Sheboygan County is not in attainment for the 8-hour standard for ground-level ozone as part of the NAAQS. Federal law requires that states prepare implementation plans for air quality (SIP) to identify how the NAAQS in the nonattainment area will ultimately be met. In Wisconsin, this is the responsibility of the WDNR. The attainment demonstration included in the SIP takes into account many emission source sectors. The Sheboygan Area Metropolitan Planning Agency becomes involved in the mobile source sector where the SIP provides emissions budgets for target future years. Transportation planning models produce estimates of mobile source emissions. Federal law requires that in nonattainment areas the planning agencies demonstrate that the mobile source emissions resulting from the modeling for transportation system activity in those target years “conform” to the budgets included in Wisconsin’s SIP. The Sheboygan Area Metropolitan Planning Organization prepares a conformity analysis for ozone for its long range transportation plan as well as its transportation improvement program. The most recent conformity analysis is contained in Appendix C of the Sheboygan MPO TIP for Calendar Years 2013 to 2016. The expansion of WIS 23 to 4 lanes is part of the assumptions of the conformity analysis and is discussed on pages C-5 and C-19. As for VOC emissions, the conformity plan states the following:

Table C.6 presents the attendant volatile organic compound emissions. The forecasts are presented for the years 2015, 2020, 2030 and 2035 for all of Sheboygan County. In addition, Table C.6 presents the 2012 and 2020 motor vehicle emissions budgets for volatile organic compounds incorporated in the “8-Hour Ozone Redesignation Request and Maintenance Plan for the Sheboygan County Subpart-2 Moderate Nonattainment Area.” The transportation system volatile organic compound emissions under the transportation system plan and transportation improvement program, when analyzed for all of Sheboygan County, are less than the motor vehicle emissions budgets for volatile organic compounds included in the “8-Hour Ozone Redesignation Request and Maintenance Plan for the Sheboygan County Subpart-2 Moderate Nonattainment Area,” thus meeting this criterion for consistency.

Table C.6 Forecast Volatile Organic Compound Emissions from the Transportation System in Sheboygan County Under the Update to the Year 2035 SATP/2013 - 2016 TIP and the State Implementation Plan for Air Quality: 2015, 2020, 2030 and 2035 (On a Hot Summer Weekday) Using Mobile 6.2 Emission Factors		
Year	Sheboygan County	
	State Implementation Plan (tons)*	Year 2035 SATP (tons)
2015	2.010	1.071
2020	1.320	0.879
2030	1.320	0.884
2035	1.320	0.919
*The State Implementation Plan budget for volatile organic compounds was 2.010 tons for 2012, and 1.320 tons for 2020.		
Source: Wisconsin Department of Natural Resources, 2010 and 2013; and Bay-Lake Regional Planning Commission, 2013.		

Note: SATP = Sheboygan Area Transportation Plan

As for NO_x emissions, the conformity plan states the following:

Table C.7 presents the forecast nitrogen oxide emissions. The forecasts are presented for the years 2015, 2020, 2030 and 2035 for all of Sheboygan County. In addition, Table C.7 presents the 2012 and 2020 motor vehicle emissions budgets for nitrogen oxides incorporated in the "8-Hour Ozone Redesignation Request and Maintenance Plan for the Sheboygan County Subpart-2 Moderate Nonattainment Area." The transportation system nitrogen oxide emissions under the transportation system plan and transportation improvement program, when analyzed for all of Sheboygan County, are less than the motor vehicle emissions budgets for nitrogen oxides included in the "8-Hour Ozone Redesignation Request and Maintenance Plan for the Sheboygan County Subpart-2 Moderate Nonattainment Area," thus meeting this criterion for consistency. It should be noted that some NO_x cutpoints were relaxed in the state's inspection and maintenance program in April 2006, resulting in small increases in NO_x emissions. This analysis assumes the same VMT and socioeconomic growth rates over the planning period as those which were assumed in the test for volatile organic compounds.

Table C.7 Forecast Nitrogen Oxide Emissions from the Transportation System in Sheboygan County Under the Update to the Year 2035 SATP/2013 - 2016 TIP and the State Implementation Plan for Air Quality: 2015, 2020, 2030 and 2035 (On a Hot Summer Weekday) Using Mobile 6.2 Emission Factors		
Year	Sheboygan County	
	State Implementation Plan (tons)*	Year 2035 SATP (tons)
2015	4.150	2.117
2020	1.790	1.300
2030	1.790	0.893
2035	1.790	0.882
*The State Implementation Plan budget for nitrogen oxides was 4.150 tons for 2012, and 1.790 tons for 2020.		
Source: Wisconsin Department of Natural Resources, 2010 and 2013; and Bay-Lake Regional Planning Commission, 2013.		

Therefore, while the Preferred Build Alternative is projected to produce more vehicle miles traveled, it represents a very modest increase in the overall VMT for Sheboygan County (0.13 percent in 2020). The conformity analysis indicates the Sheboygan Area Transportation Plan is consistent with the SIP for Air Quality even with the expansion of WIS 23 to 4 lanes. Therefore while the Preferred Build Alternative could have more VOC and NO_x emissions than the No-Build Alternative, the conformity analysis indicates the Sheboygan Area Transportation Plan is consistent with the SIP emission budgets set forth to bring the county back into attainment.

Woodlands and Ecological Resources

A comparison of pre-European settlement and current land cover data indicates that approximately 55 percent of historic forested lands remain in the study area—a significant portion of this is the Kettle Moraine State Forest. As described in Chapter 2, WDNR and other groups intend to continue to permanently preserve woodlands and other ecological resource areas through acquisition.

The construction of the Build Alternative will require 53 acres of woodlands and uplands. According to their respective regional planning commissions, Fond du Lac County has 58,700 acres of woodlands and Sheboygan County has 103,500 acres of woodlands, which is a subset of upland habitat. The Build Alternative upland requirements represent less than 1 percent of this total. Figure 20 illustrates recent residential building permits issued for Fond du Lac and Sheboygan counties and shows between 150 and 650 building permits were issued per year between 2006 and 2011. This provides a gauge of development pressures on upland habitat.

Also, as indicated in Chapter 3, expert panel members and the ICE study team generally agreed that there will be modest impact to woodlands, the Escarpment, and other resources areas of ecological significance under the Build Alternative. Such development, particularly residential, could occur in woodlands or alter woodland and wildlife habitat areas. There will be slightly increased cumulative impacts to woodlands and other ecological resources due to direct and indirect impacts from regional growth and other transportation projects. In addition, other impacts include increasing commodity prices that may lead some farmers to clear woodlands for farm fields. Panelists also indicated that invasive species, such as phragmites, spread rapidly along highway corridors, which is another possible impact of the Build Alternative.

Glacial Features

There are numerous glacial features throughout the study area. One panel member noted that these features are not currently protected through local regulation. As indicated in Chapter 3 there may be some indirect impacts to glacial features resulting from the Build Alternative due to lack of protection (e.g., overlay zoning) and modest amounts of new development. These impacts would be reduced if the WDNR implements its plans to acquire 7,000 of new land around the Kettle Moraine State Forest.

There will be slightly increased cumulative impacts to glacial features under the Build Alternative compared to the No Build Alternative due to direct and indirect impacts from impacts from regional rural residential growth and other transportation projects.

Threatened and Endangered Species

As described under the No Build Alternative, water pollution and diminished habitat since pre-European settlement has impacted wildlife and resulted in threatened and endangered species in the study area. Federal and state laws now protect threatened and endangered species from direct killing, taking, or other activities that may be detrimental to the species.

The Build Alternative's direct acquisition of 424 acres will reduce habitat. As noted in Chapter 3, indirect impacts associated with expansion of the WIS 23 corridor may include additional reduction and degradation of habitat from development, which could further threaten or potentially cause the displacement or loss of these threatened species. There will be slightly increased cumulative impacts to threatened and endangered species due to direct and indirect impacts from regional growth and other transportation projects. Other land use decisions in the region may have similar cumulative impacts.

It is difficult to estimate the presettlement populations of these rare species except by gauging changes in their potential habitat. The current amount of Wisconsin water acreages and stream threads is comparable to the amount that existed in presettlement conditions, but the water quality has diminished, likely resulting in decreased mussel populations. For the Butler's garter snake and the Blanding's turtle, it is also difficult to estimate the presettlement populations except by gauging changes in their potential habitat. Currently there are fewer forests in Wisconsin, potentially increasing their habitat, yet the quantity of quality aquatic habitat

has been reduced and habitat fragmentation has occurred. Similarly, woody species and exotic/evasive expansion into open canopy wetlands and grasslands has decreased the amount of suitable habitat for these two species.

Historic and Archaeological Resources

The most noteworthy historic site in the study area is the Wade House. As described in Chapter 2, an FEIS was prepared in 2011 to construct additional improvements within the site. Such improvements would correspond with potential expansion of WIS 23 to 4-lanes. As indicated in Chapter 3, the Wade House would be positively impacted by indirect effects associated with the Build Alternative, such as increased safety, improved access and visibility, and extension of the Old Plank Road Trail to Fond du Lac. Potential cumulative impacts associated with the Build Alternative could be an increase in tourism to the Wade House, via both WIS 23 and the Old Plank Road Trail, through increased mobility and multi-modal accessibility to the Old Wade House State Park. These could help increase the number of visitors per year, an indirect effect. This contributes to a possible cumulative effect of increased tourism when combined with actions being taken by the Old Wade House State Park to increase visitors.

As for direct effects of the Preferred Build Alternative, the proposal will not affect St. Mary's Springs Academy (eligible for the NRHP) nor will it adversely affect the Old Wade House State Park. Data recovery will be performed at the Sippel archaeological site, which will be affected by the Preferred Build Alternative. So the direct effects of the Preferred Build Alternative will have a modest contribution to cumulative effects to historic resources.

Other actions that could affect historic and archeological sites include the redevelopment and/or razing of existing buildings with historic significance. Also, residential and commercial development activities that alter the landscape could adversely affect unknown archeological resources. The number of historic resources within Fond du Lac and Sheboygan Counties is briefly discussed in Chapter 2 and includes 4,119 historic listings for Fond du Lac County and 2,664 historic listings for Sheboygan County on Wisconsin's Architecture and Historic Inventory. The direct effects of WIS 23 improvements, combined possible redevelopment and development impacts, could create a cumulative impact to historic resources. However, this impact is anticipated to be modest when compared to the direct effects of Build Alternative. The reasoning behind characterizing the effects as modest is that the WIS 23 Build Alternative will disturb about 430 acres of new right of way and will have an adverse effect on only one archaeological site eligible for the NRHP, and that is being mitigated. If increased mobility associated with the Build Alternative induced an additional 100 new residences in the ICE study area in the future in which each home disturbed 0.25 acres, that results in just 25 acres of ground disturbance, or 6 percent of the WIS 23 direct effect. While this analysis assumes a uniform distribution of archaeological sites, which in reality does not occur, it does provide an order of magnitude estimate.

Trails

State, county, and local governments in the study area continually plan for the acquisition and development of new trails, as described in Chapter 2. Other agencies, such as the Niagara Escarpment Network, also work towards these goals. As described in Chapter 3, the potential indirect impacts to trails include extension of the Old Plank Road Trail to Fond du Lac; safety improvements for existing trails that cross WIS 23; possible economic benefits resulting from increased trail use and park attendance; and lands not under protective ownership may be at heightened risk for future non-park or trail development. Other trail improvements in the region include the Wild Goose-Prairie Connector, the Mascoutin Valley Trail Extension, and Union Pacific Trail Conversion. Adding the cumulative effect on trails and non-motorized travel are the provisions contained in Wisconsin Administrative Code Trans 75, which requires bicycle and pedestrian facilities on highway projects unless the project qualifies for an exception.

These factors, taken with the plans to develop new trails, may result in the following cumulative impacts under the Build Alternative: improved local and regional trail network connecting to trails beyond county

boundaries; increased usership of recreational trails (including Old Plank Road Trail) for transportation purposes; and public health benefits associated with trail activity.

Community Character

As mentioned under the No Build Alternative, the existing community character in the study area is defined by urban areas, agricultural lands, and unique natural features. As indicated in Chapter 3, the Build Alternative may cause indirect impacts in the study area. Cumulative impacts to community character will ultimately be dependent upon local government regulation and quality of development.

Due to the tendency of access limitations to concentrate new development at new interchanges, and between such interchanges and nearby urban centers (i.e., strip development), rather than the historic pattern of relatively dispersed development, the adverse cumulative effects of the Build Alternative on small town and rural community character is likely to be stronger than under the No Build Alternative. This loss of rural character will likely occur at County UU, County W (north), and County G. The hamlet character of Greenbush is likely to be affected, as is the County A corridor between WIS 23 and the village of Glenbeulah. In general, as small town and rural areas experience development, their community character is threatened by both the amount and ubiquitous suburban nature of new development. Area communities currently do not strongly address community character in their adopted plans or in their development regulations. Rural communities, which have these regulations in place, generally have protected small town and rural character more successfully.

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CHAPTER 5: ACTIVITIES TO AVOID, MINIMIZE, OR MITIGATE EFFECTS

This chapter identifies the efforts taken during the NEPA project development process to avoid, minimize, and mitigate project impacts to the human and natural environment. The analysis in Chapters 3 and 4 indicate the predominant indirect effect from the Preferred Alternative is the potential increased pace of development that could occur outside the urban centers as a result of improved safety and increased mobility on WIS 23. Since most of the sensitive resources in the ICE study area are located in nonurban areas, the consequence of the rural development indirect effects include adverse impacts on agricultural land, water quality, and upland habitat, which are not protected to the same extent as wetlands. Recent population projections, however, indicate this effect may be dampened.

The WIS 23 Preferred Alternative will also contribute to the cumulative effect on resources, with other contributors being past, present, and future actions by other entities. The predominant contribution to cumulative effects from the WIS 23 Preferred Alternative includes loss of farmland, loss of uplands, degradation of water quality, and a small degradation air quality.

NEPA does not specifically require substantive mitigation for project impacts; direct, indirect, or cumulative. The CEQ regulations require that the environmental impacts statement include consideration and discussion of possible mitigation for project impacts (40 CFR §§ 1502.14(f), 1502.16(e-h), 1505.2(c), 1508.25(b)(3)).⁸

Questions 19a. and 19b. of the *CEQ 40 Questions and Answers* provide additional guidance on mitigation to be addressed and documented in a NEPA document.

“The mitigation measures discussed in an EIS must cover the range of impacts of the proposal. The measures must include such things as design alternatives that would decrease pollution emissions, construction impacts, aesthetic intrusion, as well as relocation assistance, possible land use controls that could be enacted, and other possible efforts.”

“All relevant, reasonable mitigation measures that could improve the project are to be identified, even if they are outside the jurisdiction of the lead agency or the cooperating agencies, and thus would not be committed to as part of the RODs of these agencies. This will serve to alert agencies or officials who can implement these extra measures, and will encourage them to do so. To ensure that environmental effects of a proposed action are fairly assessed, the probability of the mitigation measures being implemented must also be discussed. Thus the EIS and the Record Of Decision should indicate the likelihood that such measures will be adopted or enforced by the responsible agencies.”

Provisions regarding FHWA’s legal responsibility and authority for mitigating project impacts are found in FHWA’s Environmental regulations Section 771.105(d):

“Measures necessary to mitigate adverse impacts will be incorporated into the action and are eligible for Federal funding when the Administration determines that:

1. The impacts for which the mitigation is proposed actually result from the Administration action; and
2. The proposed mitigation represents a reasonable public expenditure after considering the impacts of the action and the benefits of the proposed mitigation measures. In making this determination, the

⁸ <http://www.environment.fhwa.dot.gov/projdev/qaimpact.asp> June 2013

Administration will consider, among other factors, the extent to which the proposed measures would assist in complying with a Federal statute, Executive Order, or Administration regulation or policy."

It is important that we understand how mitigation is defined in the NEPA process. Replacement or compensation is the last of a sequence of considerations that constitute the overall mitigation expectation of the CEQ regulations (40 CFR § 1508.20). Mitigation includes avoidance and minimization of project impacts first. This hierarchy is often referred to as "sequencing" and means that impact avoidance and minimization measures should be considered early and as an integral component of the alternatives development and analysis process. Replacement or compensation for impacts are intended primarily to deal with residual impacts that cannot be avoided or minimized.

The following paragraphs summarize project sequencing as it pertains to all impacts, direct, indirect, and cumulative. While this report specifically addresses indirect and cumulative effects, direct effects represent WIS 23's contribution toward the cumulative effect on a resource and are therefore discussed.

Avoidance Measures

Corridor Selection

In the development, evaluation, and screening of alternative corridors, WisDOT considered both the direct environmental impacts of the corridor alternatives as well as the indirect and cumulative effects. The consideration of direct, indirect, and cumulative effects led to the selection of the on-alignment corridor, Alternative 1, as the Preferred Alternative. The selection of Alternative 1 had the following effects:

- It reduced the quantity of direct impacts to farmland, wetlands, and uplands. In doing so, it reduced the highway improvement's contribution to cumulative effects. (See Table 4.5-1 of the LS SDEIS. Alternative 1 requires up to 23 percent less right of way and 42 percent fewer wetland impacts than some of the off-alignment alternatives.)
- It reduced the number of severed farm parcels and the amount of farmland required. Alternative 1 requires up to 57 percent less farmland than some of the off-alignment alternatives. Farm severances make agriculture less sustainable and can lead to a reduction in farming activities and the conversion of severed parcels to other land uses (an indirect effect). Alternative 1 had the least amount of farm severances and cropland required.
- It reduced the amount of roadway lane mileage associated with WIS 23 improvements. Selection of an off-alignment corridor would have increased lane mileage because new bypass lanes would be constructed in addition to the existing WIS 23 lanes. Alternative 1 would have about a third less pavement than some off-alignment alternatives. Additional lane mileage has direct environmental effects, such as degraded water quality, induced traffic, the corresponding air quality impacts, and severance of natural communities. Selection of Alternative 1 avoided the impacts that would have occurred with additional lane mileage of the off-alignment alternatives.
- It avoided potential residential and commercial development from occurring along an off-alignment corridor (an indirect effect). This included avoiding the corresponding environmental impacts that would have been associated with this development.

In addition to the selection of Alternative 1 as the Preferred Alternative, WisDOT also selected the No Corridor Preservation Option for the US 151/WIS 23 connection. By not preserving lands for a future system interchange, WisDOT avoided potential indirect effects to properties adjacent to the options. The avoided indirect effects included decreased marketability of parcels and potentially reduced investment and reinvestment in affected properties.

Alignment Refinements

With the selection of Alternative 1 as the Preferred Alternative, several alignment modifications were incorporated into the alternative to avoid direct impacts, which then decrease the cumulative impact of the project on area resources. These alignment refinements included shifting the roadway alignment north of the Old Wade House State Park and south of the Pit Road wetland mitigation site. The Old Plank Road Extension was brought closer to the WIS 23 highway as it traveled across the Old Wade House State Park to reduce impacts to wetlands. Slopes were also steepened in wetland areas to reduce impacts. These refinements decreased wetland impacts, decreasing the cumulative effect of the project on area wetlands.

Preferred Alternative Features

WisDOT seeks to incorporate design components and features into the Preferred Alternative that minimize the adverse effects of the potential project. Many of these components address direct effects, but they also have regional influence. The WIS 23 Preferred Project incorporates a 16-mile extension of the Old Plank Road Trail. This extension enhances the ability of WIS 23 to serve nonmotorized modes of transportation and offsets potential negative project effects to nonmotorized modes.

Minimization Measures

Impact Minimization

Through the final design process, WisDOT seeks to minimize impacts to adjacent properties and resources. This minimization reduces the direct impacts of the alternatives, which contribute to the overall cumulative impacts on particular resources. Between the publishing of the 2010 FEIS, design refinements have reduced the amount of impact on some resources, such as cropland which was reduced by 20 acres and uplands/woodlands which was reduced by 24 acres. Some impact categories have risen since the publishing of the 2010 FEIS- mostly due to revised boundaries (wetlands) or property owner requests (residential relocations).

Construction Impact Minimization

WisDOT will seek to minimize construction impacts through the implementation of various measures, which are described in Section 6 of the LS SDEIS. These measures reduce direct construction impacts, which consequently reduce the project's contribution on the cumulative impact on these resources. Measures to minimize construction impacts include the following:

- A transportation management plan (TMP) will provide reasonably convenient access to residences, businesses, farm parcels, community services, and local roads during construction.
- Special provisions to reduce the short-term impacts of construction noise will require that motorized equipment be operated in compliance with all applicable local, state, and federal laws and regulations on noise levels permissible within and adjacent to the project construction site.
- The special provisions and plan set will include measures to reduce water quality and quantity impacts occurring through construction. WisDOT through Trans 401, Wisconsin Administrative Code, and the WisDOT/WDNR Cooperative Agreement will comply with the substantive requirements of Chapter 147, Wisconsin Statutes, Wisconsin Pollutant Discharge Elimination System (WPDES) to reduce water quality and hydrology impacts. Precautions will be taken at the Sheboygan River and Mullet River Creek crossings to preclude erosion and stream siltation.

- To reduce impacts to wildlife, construction work will be scheduled during non-breeding seasons. Section 4.6 C-7 of this LS SDEIS details commitments being made to reduce impacts to rare species as coordinated with the WDNR over the winter of 2013.
- During construction, impacts to wetlands from erosion and sediment transport will be minimized or prevented by implementing erosion control best management practices as specified in the construction contract
- For agriculture, reasonable access will be provided to farms. Existing drainage systems (ditches and tiles) will be kept operational during construction.

Access Management

WisDOT implements access management on roadways and access points along state highways. The implementation of access management can affect the development potential of properties served by that project (an indirect effect). In implementing access management, WisDOT seeks not to restrict or impede existing land uses but seeks to prevent traffic from potential future development from negatively impacting highway operations. By implementing access restrictions, new development, particularly commercial development, is less likely to occur near the access restriction. Similarly, by permitting access, development is able to occur in planned locations and at higher densities. The WIS 23 Preferred Alternative incorporates access management, which is detailed in Table 2.7-1 of the LS SDEIS for the project. Of the current 42 full-access intersections, the Preferred Alternative incorporates 6 cul-de-sacs, 14 right-in/right-out access restrictions, 10 J-turn access restrictions, and 3 interchanges/jug-handle. While providing sufficient local access, these access restrictions will have the effect of directing development away from rural intersections with less access toward intersections with more access.

Mitigation Measures

Direct Impact Mitigation and Corresponding Contribution to Cumulative Impacts

WisDOT is providing mitigation for several types of direct impacts. Mitigating direct impacts reduces or eliminates the WIS 23 project's contribution to cumulative impacts of specific resources. Direct impact mitigation includes:

- The mitigation of approximately 48 acres of wetlands being filled through the establishment of a wetland mitigation bank. (See Section 4.6 C-1 of the LS SDEIS.)
- The provision of a grade-separated crossing of WIS 23 for the Ice Age Trail and State Equestrian Trail. (See Section 5.3 of the LS SDEIS.)
- The replacement of 2.2 acres of land required from the Northern Unit of the Kettle Moraine State Forest with 4.275 acres of land to be transferred to State Forest ownership. (See Section 5.3 of the LS SDEIS.)
- The Phase III data recovery at the Sippel Archaeological Site to document the information from this archaeological resource. (See Section 4.6 B-6 of the LS SDEIS.)

Avoidance, Minimization, and Mitigation Measures Outside of WisDOT's and FHWA's Jurisdiction.

Although neither WisDOT nor FHWA has jurisdiction over local land use policy and, or decisions, the project team has identified several avoidance, minimization, and mitigation measures that may reduce indirect and cumulative impacts further if implemented by other entities. They are identified here for consideration by the appropriate outside entities. Policy choices by local governments regarding planning and existing and future land use regulations can play a large role in either facilitating or minimizing potential indirect effects of the WIS 23 project. WisDOT can control WIS 23's direct effects that contribute to the cumulative effect of other past, present, and future actions on resources. Local jurisdictions through land use policies and decisions have a greater influence on other actions that contribute to cumulative effects. Land use tools available to local jurisdictions commonly used to avoid and reduce impacts to resources include the following:

- **Comprehensive Planning.** Wisconsin law requires communities that wish to regulate land adopt a comprehensive plan to guide local land use decisions. These decisions—for example, the location, type, quantity and character of development, protection of agricultural lands and natural resources, local utilities and community facilities, and economic development initiatives—are closely related to impacts analyzed in this report. Comprehensive plans may be amended from time to time and are required to undergo a complete update every ten years. In the central and eastern portions of the corridor, adopted town and village plans are generally designed to protect farmland and limit sprawl.
- **Zoning.** A zoning ordinance and map can be used to determine appropriate locations and other regulations for specific land uses. For example, zoning land for exclusive agricultural use can help ensure that it will not be developed for nonagricultural uses until zoning policies have changed or a rezoning has occurred. Overlay zoning above and beyond state and federal regulations for natural resource features, such as isolated wetlands, uplands woodlands, shorelands, steep slopes, drainageways, habitat areas, and historic sites, may also be adopted by local jurisdictions. Modern zoning ordinances also contain provisions that protect and enhance community character. Within the ICE study area, preservation of the hamlet character of Greenbush and limiting strip development along County A between WIS 23 and the village of Glenbeulah could be achieved through modern zoning. According to state law, zoning ordinances and maps are required to be consistent with the local comprehensive plan.
- **Land Division.** Land division ordinances must also be consistent with the local comprehensive plan under state law. These ordinances determine the manner in which land may be divided, design standards, types of public improvements needed to serve development, access control at time of land division, and, in conjunction with the zoning ordinance, the development density.
- **Extraterritorial Jurisdiction.** Wisconsin Statutes specifically allow cities and villages to prepare plans for and to regulate land divisions within their extraterritorial jurisdictions in unincorporated (township) areas. Such extraterritorial powers can help reduce development in agricultural areas and can help ensure that when development does occur, it can be developed in a manner consistent with local zoning and the comprehensive plan.
- **Official Mapping.** Official mapping is a plan implementation tool authorized under Wisconsin Statutes for adoption as an ordinance by cities, villages, and towns. These maps may be used to show alignments of future roads, expanded rights-of-way for existing roads, and other planned public facilities, such as parks and trails. When land development is proposed in an area with a planned facility as depicted on the official map, the municipality may obtain or reserve land for that future facility through public dedication, public purchase, or reservation for future purchase.

- **Conservation Easements.** Purchase of agricultural or conservation easements to prohibit development are voluntary and allow the landowner to be compensated for limiting the development potential of the land. Conservation easements are permanent and are carried over to subsequent landowners when the property is sold. This tool is particularly effective for resources that have a limited area that is definitively mapped. Within the ICE study area, this tool may be well suited to preserve the Niagara Escarpment.
- **Urban Service Area.** In Wisconsin, urban service area boundaries around municipalities may be legally extended (e.g., public sewer and water). Urban service areas are useful in managing the location and timing of urban and suburban growth.
- **Tax Increment Financing (TIF).** Communities may utilize TIF to fund public improvements that would otherwise not occur without the use of TIF. Local governments may adopt TIF districts to direct development and redevelopment to specific locations in a community. Typically, these are compact areas served by public utilities.
- **Stormwater Best Management Practices.** Traditional stormwater management practices attempt to carry water away from a developed site as quickly as possible after a storm or are designed to hold water on-site in constructed ponds. Alternatively, stormwater best management practices (BMPs) aim to control runoff by managing precipitation as close to where it hits the ground as possible, thereby facilitating infiltration of precipitation into groundwater and evaporation of water back into the atmosphere. This approach decreases peak stormwater quantities and improves the overall quality of the stormwater that does enter streams and lakes. The severity of water quality impacts is dependent on the magnitude and duration of upstream hydrologic events including sediment inputs, flooding, and land use change. However, these impacts may be minimized through local and county stormwater ordinances and best management practices.

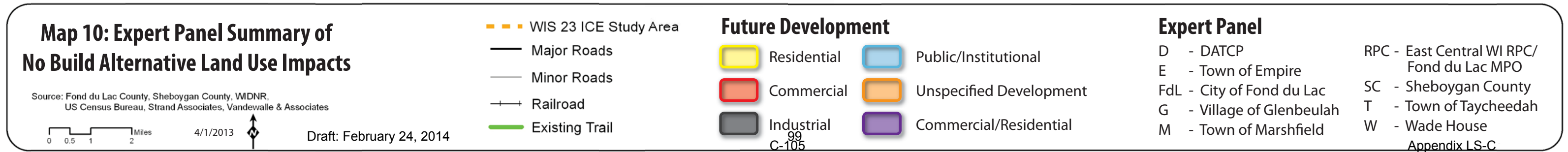
Monitoring and Evaluation of Direct, Indirect, and Cumulative Effects

Section 6 of the LS SDEIS contains the commitments to mitigation and monitoring regarding effects of the Preferred Alternative. It includes continued coordination with WDNR regarding threatened and endangered species, commitments regarding archaeological and historic sites, wetland monitoring, as well as measures to offset impacts to Section 4(f) properties. WisDOT will work within its jurisdictional limitations to minimize adverse indirect and cumulative effects. These efforts will be primarily associated with the roadway project corridor and are primarily limited to the duration of the construction project. Local communities and state agencies with jurisdiction in the study area will have the ability to monitor and evaluate impacts on land and resources on a long-term basis. Communities have the ability to approve or not approve development decisions and can influence the pace of development for years after WIS 23 improvements are completed. Other agencies with federal authority, such as the US EPA and US Army Corps of Engineers, also have the authority to monitor impacts to natural resources such as floodplains, wetlands, and water quality.







APPENDIX A: EXPERT PANEL SUMMARY MAPS

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No Build could result in scattered development with a larger impact on resources than build.
(RPC)



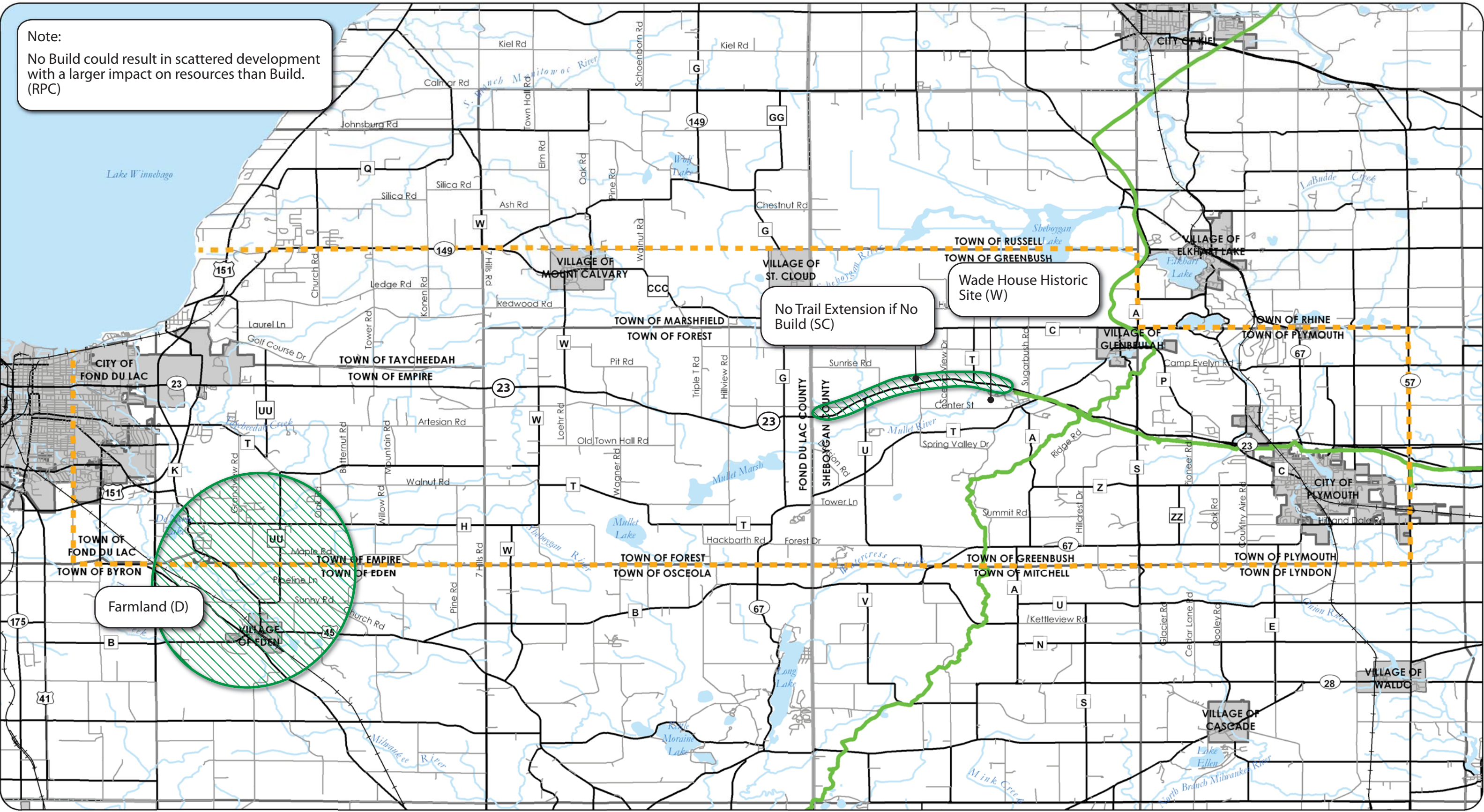
Draft: February 24, 2014

 Residential
  Public/Institutional
 Commercial
  Unspecified Development
 Industrial
  Commercial/Residential

99
C-105

D	- DATCP	RPC	- East Central WI RPC/ Fond du Lac MPO
E	- Town of Empire	SC	- Sheboygan County
FdL	- City of Fond du Lac	T	- Town of Taycheedah
G	- Village of Glenbeulah	W	- Wade House
M	- Town of Marshfield		Appendix I S-C

Note:
No Build could result in scattered development with a larger impact on resources than Build.
(RPC)



**Map 11: Expert Panel Summary of
No Build Alternative Resource Impacts**

Source: Fond du Lac County, Sheboygan County, WDNR,
US Census Bureau, Strand Associates, Vandewalle & Associates

0 0.5 1 2 Miles

4/1/2013

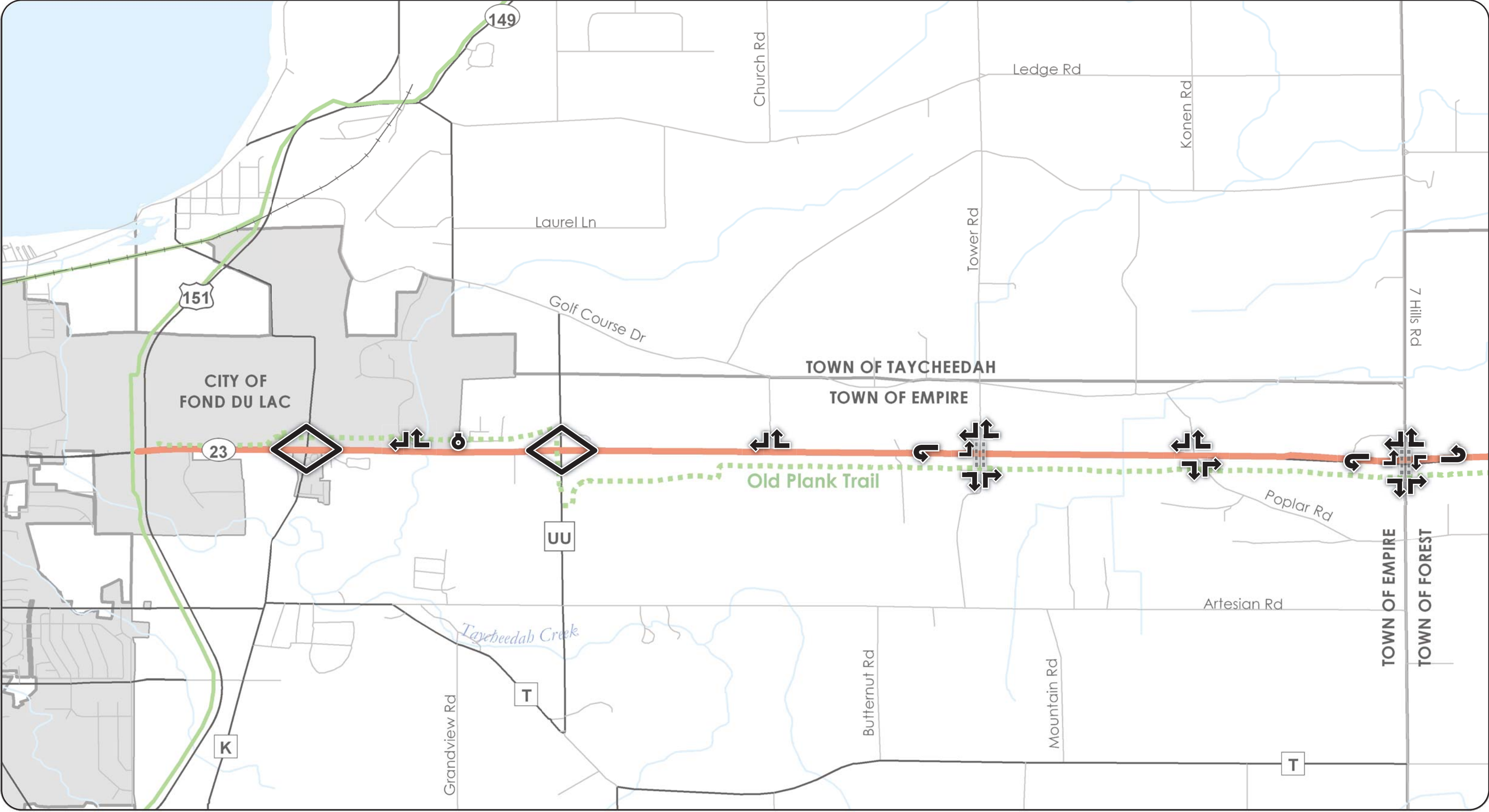
Draft: February 24, 2014

- WIS 23 ICE Study Area
- Major Roads
- Minor Roads
- Railroad
- Existing Trail

Legend
 Resources

Expert Panel

- | | |
|---------------------------|---|
| D - DATCP | RPC - East Central WI RPC/
Fond du Lac MPO |
| E - Town of Empire | SC - Sheboygan County |
| FdL - City of Fond du Lac | T - Town of Taycheedah |
| G - Village of Glenbeulah | W - Wade House |
| M - Town of Marshfield | |



Map 12: Build Alternative Improvements (West)

- | | | | |
|-----------------------|--------------------------|--|---|
| WIS 23 | County Boundary | Proposed Build Alternative Interchange or Jug Handle | Proposed Corridor Preservation Alternative Future Interchange |
| WIS 23 ICE Study Area | City or Village Boundary | Cul de Sac | Future Grade Separation |
| Existing Trail | Town Boundary | Right-In/Right-Out | |
| Proposed Trail | Surface Water | Left-In | |
| | | J-Turn | |

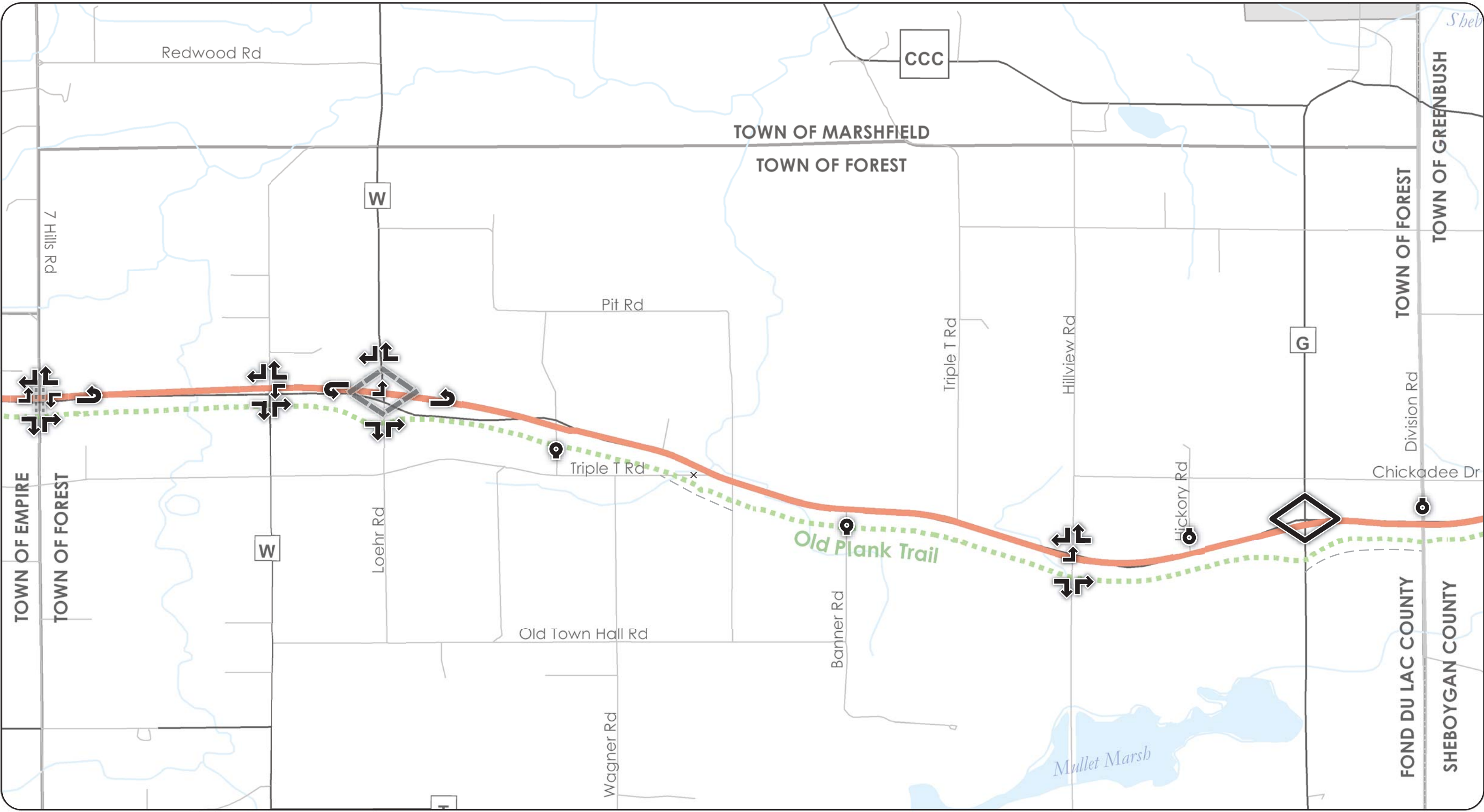
Sources: Fond du Lac County, Sheboygan County, WIDNR, WisDOT, US Census Bureau, Strand Associates, Vandewalle & Associates

0 0.25 0.5 Miles

4/1/2013



Draft: February 24, 2014



Map 13: Build Alternative Improvements (Central)

Sources: Fond du Lac County, Sheboygan County, WIDNR, WisDOT, US Census Bureau, Strand Associates, Vandewalle & Associates

0 0.25 0.5 Miles

4/1/2013



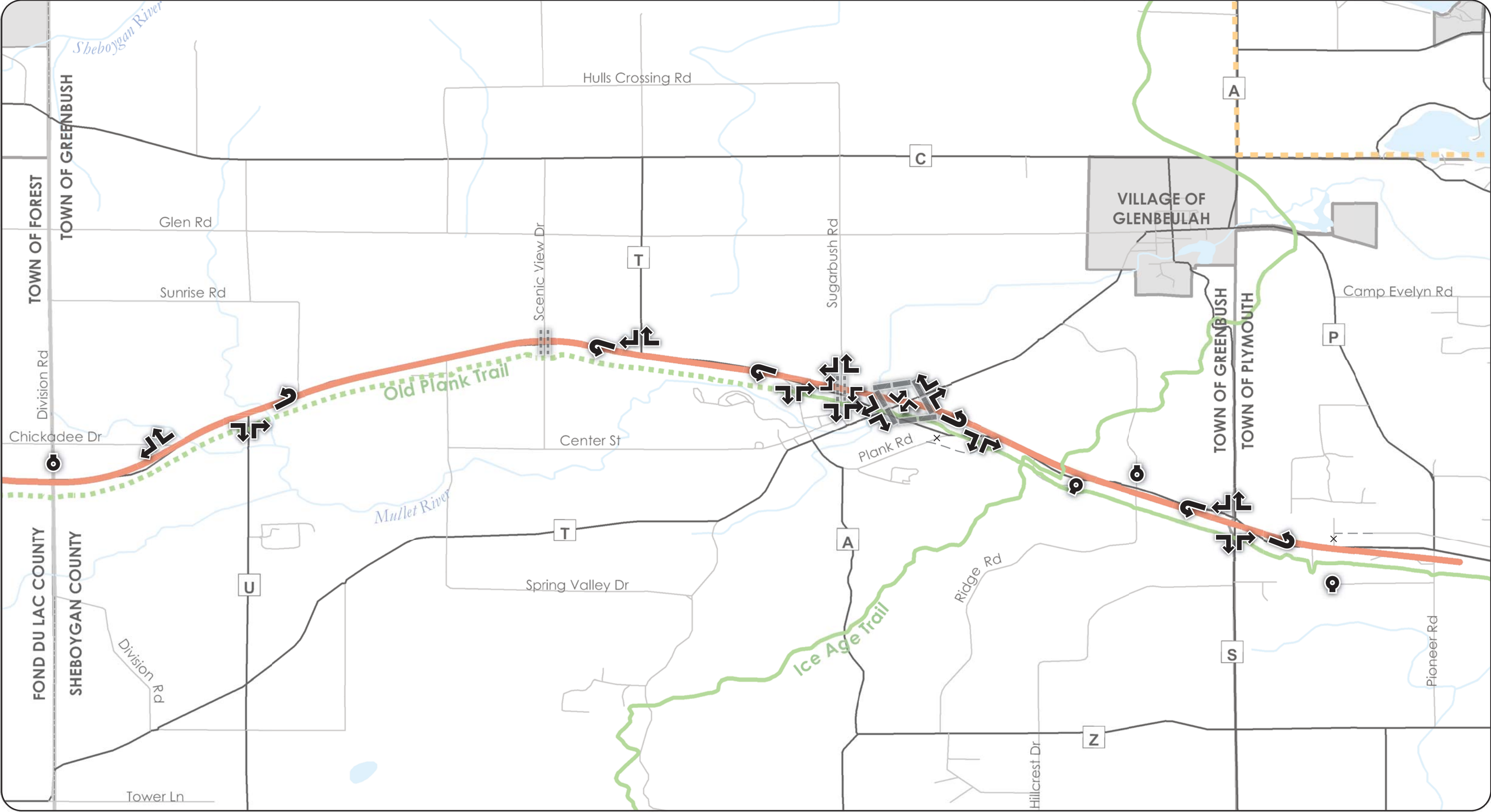
Draft: February 24, 2014

- WIS 23
- WIS 23 ICE Study Area
- Existing Trail
- Proposed Trail

- County Boundary
- City or Village Boundary
- Town Boundary
- Surface Water

- Proposed Build Alternative**
 - Interchange or Jug Handle
 - Cul de Sac
 - Right-In/Right-Out
 - Left-In
 - J-Turn

- Proposed Corridor Preservation Alternative**
 - Future Interchange
 - Future Grade Separation



Map 14: Build Alternative Improvements (East)

Sources: Fond du Lac County, Sheboygan County, WIDNR, WisDOT, US Census Bureau, Strand Associates, Vandewalle & Associates

0 0.25 0.5 Miles

4/1/2013



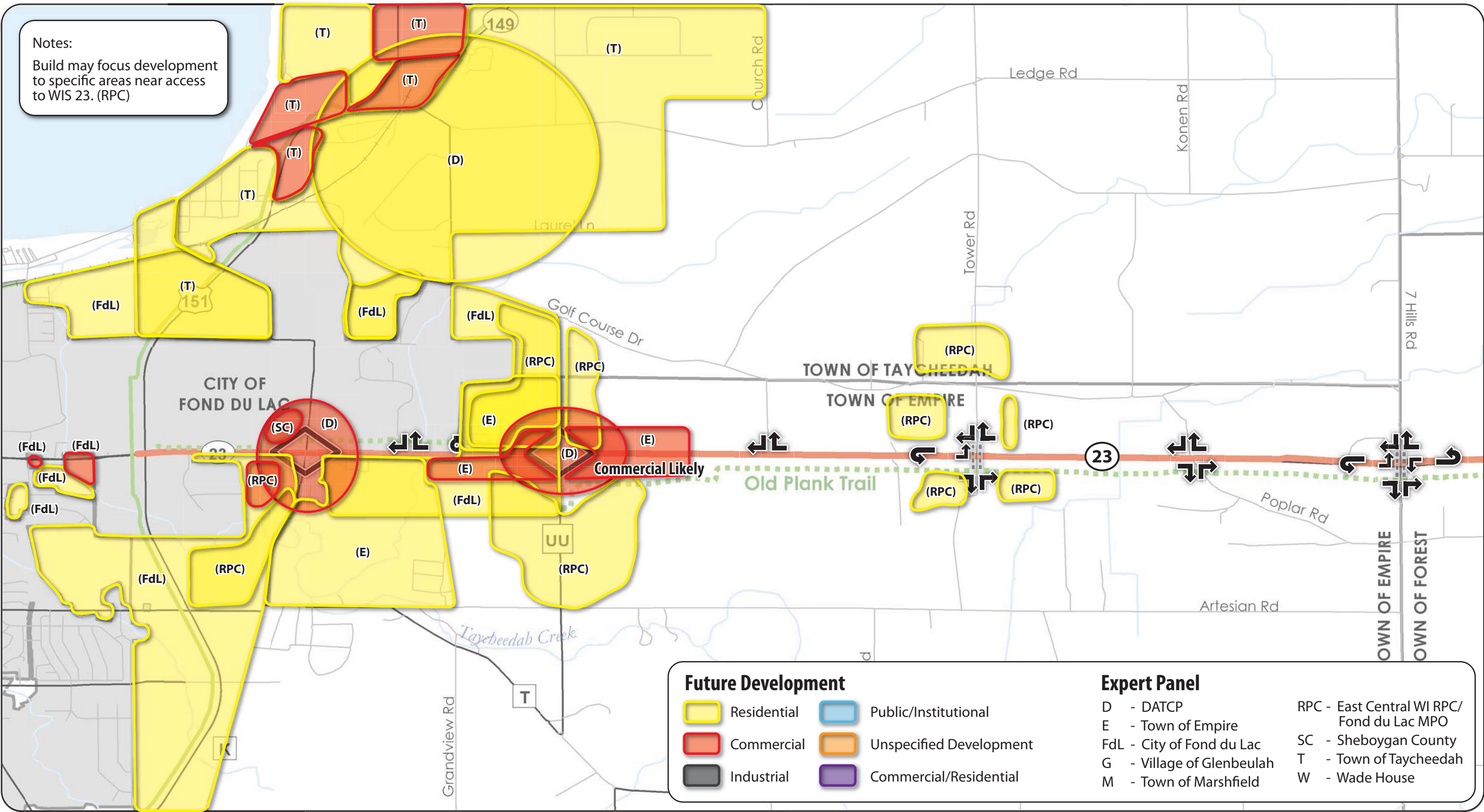
Draft: February 24, 2014

- County Boundary
- City or Village Boundary
- Town Boundary
- Surface Water

- Proposed Build Alternative**
 - Interchange or Jug Handle
 - Cul de Sac
 - Right-In/Right-Out
 - Left-In
 - J-Turn

- Proposed Corridor Preservation Alternative**
 - Future Interchange
 - Future Grade Separation

Notes:
Build may focus development to specific areas near access to WIS 23. (RPC)



Map 15: Expert Panel Summary of Build Alternative (West) Land Use Impacts

Sources: Fond du Lac County, Sheboygan County, WDNR, WisDOT, US Census Bureau, Strand Associates, Vandeville & Associates

0 0.25 0.5 Miles

4/1/2013

Draft: February 24, 2014

- WIS 23
- WIS 23 ICE Study Area
- Existing Trail
- Proposed Trail

- County Boundary
- City or Village Boundary
- Town Boundary
- Surface Water

- Proposed Build Alternative
- Interchange or Jug Handle
- Cul de Sac
- Right-In/Right-Out
- Left-In
- J-Turn

- Proposed Corridor Preservation Alternative
- Future Interchange
- Future Grade Separation

Notes:

Build may focus development to specific areas near access to WIS 23. (RPC)

Slight Reduction
in Residential Development

TOWN OF MARSHFIELD

TOWN OF FOREST

TOWN OF GREENBUSH

TOWN OF FOREST

Division Rd

FOND DU LAC COUNTY

SHEBOYGAN COUNTY



TOWN OF EMPIRE
TOWN OF FOREST

(RPC)

(RPC)

(RPC)

(RPC)

(RPC)

(RPC)

(RPC)

Commercial
Likely

(D)

Industrial
Likely

Future Development

- Residential
- Commercial
- Industrial
- Public/Institutional
- Unspecified Development
- Commercial/Residential

Expert Panel

- D - DATCP
- E - Town of Empire
- FdL - City of Fond du Lac
- G - Village of Glenbeulah
- M - Town of Marshfield
- RPC - East Central WI RPC/
Fond du Lac MPO
- SC - Sheboygan County
- T - Town of Taycheedah
- W - Wade House

Map 16: Expert Panel Summary of Build
Alternative (Central) Land Use Impacts

Sources: Fond du Lac County, Sheboygan County, WIDNR, WisDOT,
US Census Bureau, Strand Associates, Vandeville & Associates

0 0.25 0.5 Miles

4/1/2013

Draft: February 24, 2014

- WIS 23
- WIS 23 ICE Study Area
- Existing Trail
- Proposed Trail

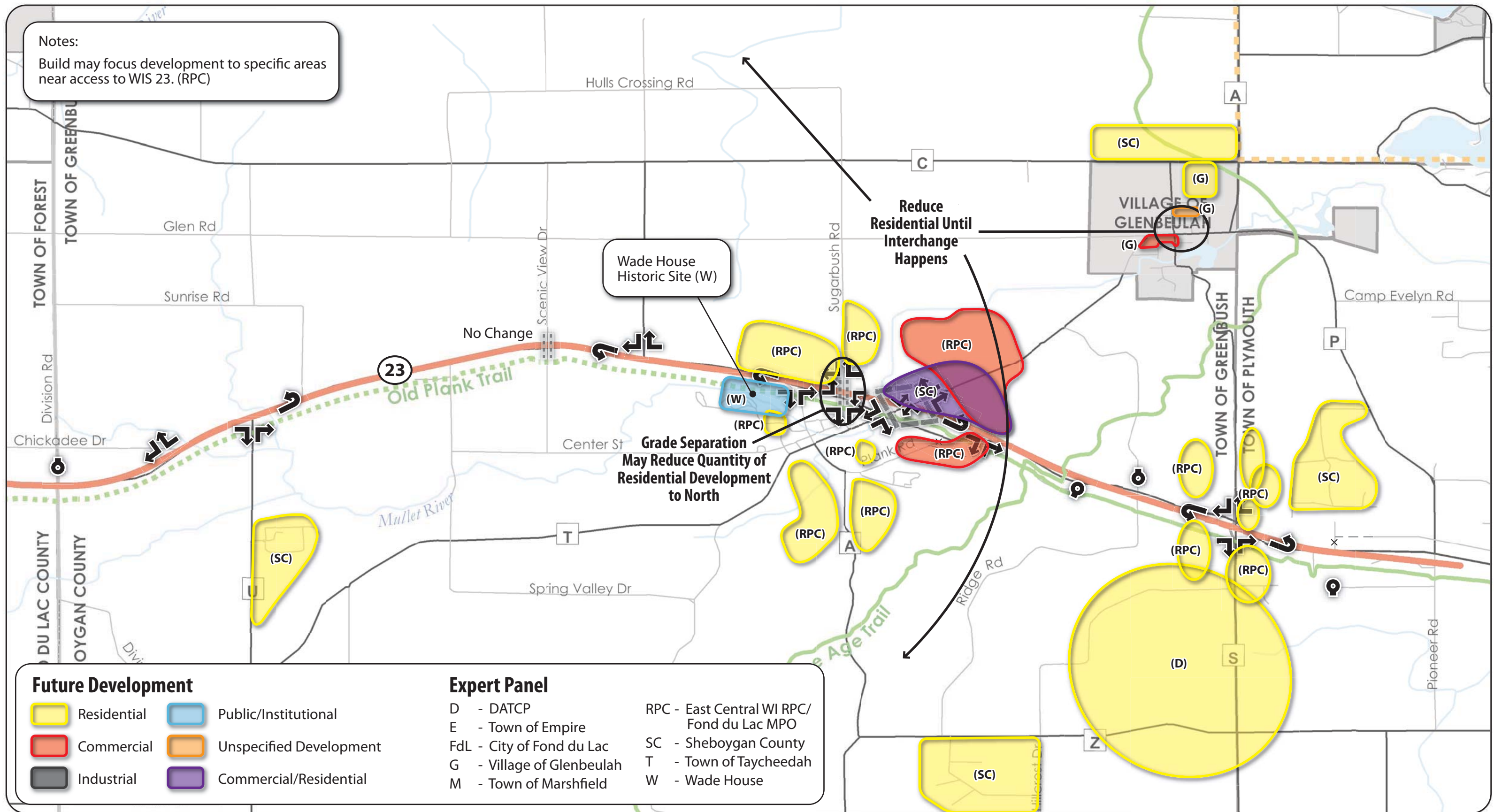
- County Boundary
- City or Village Boundary
- Town Boundary
- Surface Water

- Proposed Build Alternative
Interchange or Jug Handle
- Cul de Sac
- Right-In/Right-Out
- Left-In
- J-Turn

- Proposed Corridor Preservation Alternative
Future Interchange
- Future Grade Separation

Notes:

Build may focus development to specific areas near access to WIS 23. (RPC)



Proposed Build Alternative

Interchange or Jug Handle

Cul de Sac

Right-In/Right-Out

Left-In

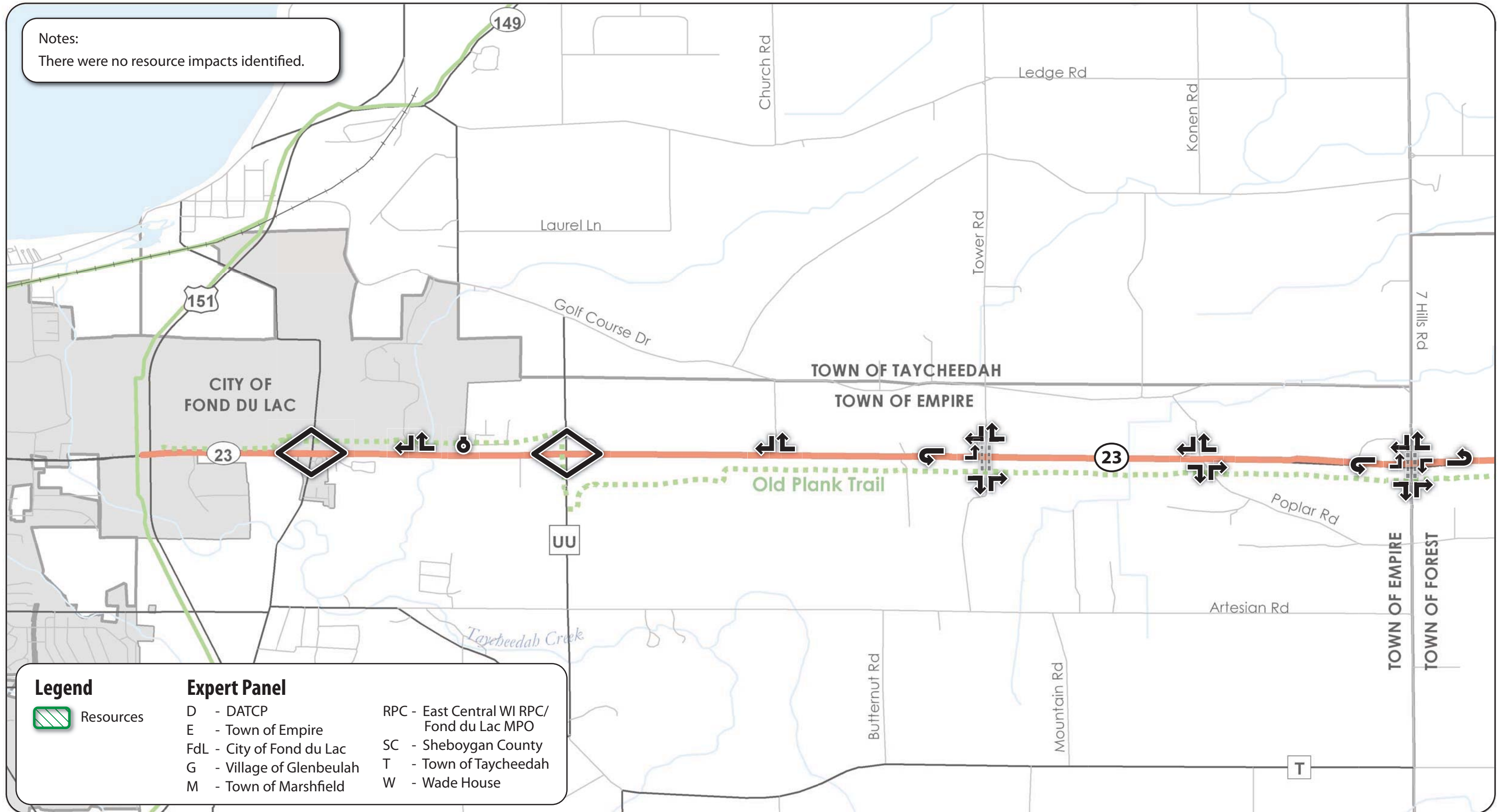
J-Turn

Proposed Corridor Preservation Alternative

Future Interchange

Future Grade Separation

Notes:
There were no resource impacts identified.



Map 18: Expert Panel Summary Build Alternative (West) Resource Impacts

Sources: Fond du Lac County, Sheboygan County, WDNR, WisDOT, US Census Bureau, Strand Associates, Vandeville & Associates

0 0.25 0.5 Miles

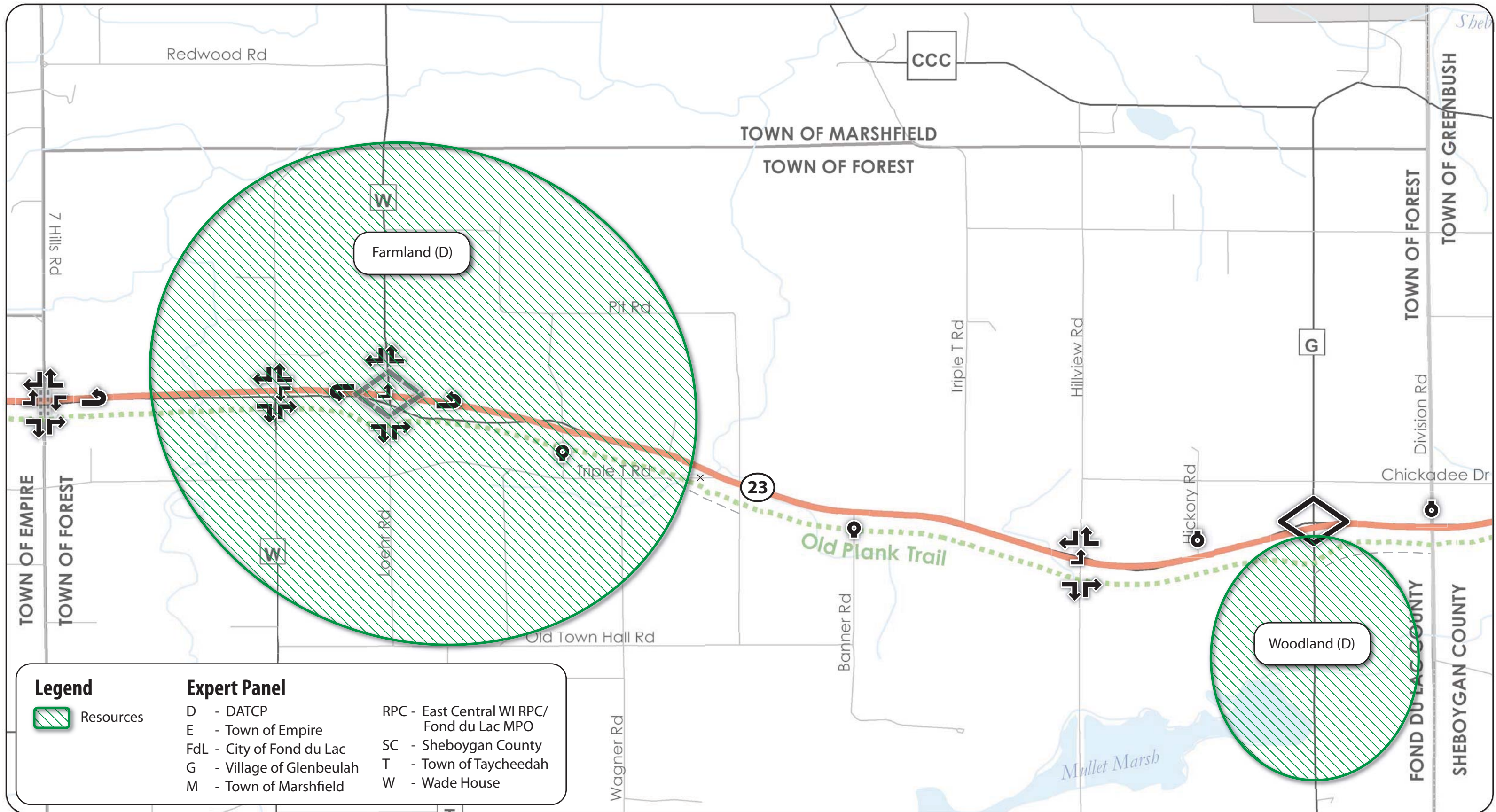
4/1/2013

Draft: February 24, 2014

- County Boundary
- City or Village Boundary
- Town Boundary
- Surface Water

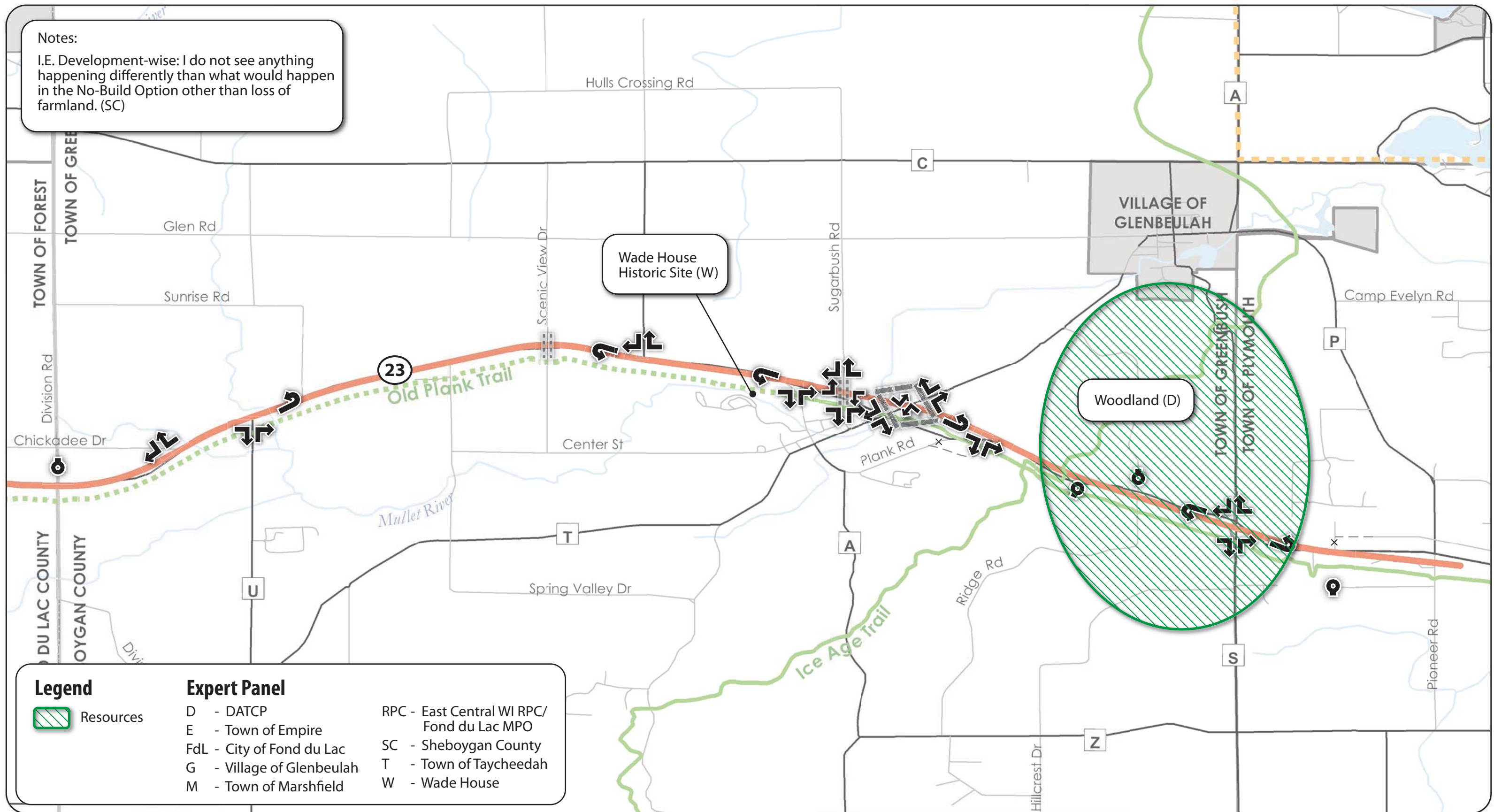
- Proposed Build Alternative**
- Interchange or Jug Handle
 - Cul de Sac
 - Right-In/Right-Out
 - Left-In
 - J-Turn

- Proposed Corridor Preservation Alternative**
- Future Interchange
 - Future Grade Separation



Notes:

I.E. Development-wise: I do not see anything happening differently than what would happen in the No-Build Option other than loss of farmland. (SC)



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APPENDIX B: EXPERT PANEL SURVEY RESULTS

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WIS 23 Indirect and Cumulative Effects Questionnaire



1. Please enter your name and the jurisdiction/agency you are representing below.

	Response Percent	Response Count
Name	100.0%	22
Jurisdiction/Agency	100.0%	22
answered question		22
skipped question		0

- | | | |
|---|--|--|
| <ul style="list-style-type: none"> • Roger Rortvedt, Town of Plymouth • Michael Limberg, Town of Greenbush • Dan Weidert, Eastern FDL & Sheboygan Counties/DNR Wildlife Management • Vickie Hall, Glacial Lakes Conservancy • Kevin Struck, UW-Extension Sheboygan County • Peter Nauth, DATCP • Harold Barfknecht, Town of Forest, Fond du Lac County | <ul style="list-style-type: none"> • Walt Raith, Fond du Lac MPO/East Central WI Regional Planning • Bill Immich, City of Plymouth • David Simmons, Wade House Historic Site / Wisconsin Historical Society • Aaron Brault, Sheboygan County • Eric Fowle, Niagara Escarpment Resource Network / ECWRPC • Bethaney Bacher-Gresock, FHWA - WI • Michael Born, Village of St. Cloud | <ul style="list-style-type: none"> • Ken Kraus, Town of Marshfield • Mike Rankin, UWEX • Jerry Olig, Village of Mt Calvary • Brenda Schneider, Town of Taycheedah • Jeff Agee-Aguayo, Bay-Lake Regional Planning Commission • Wayne Rollin, City of Fond du Lac • Sam Tobias, Fond du Lac County, Planning Department |
|---|--|--|

2. Will the pace of future residential development occur at a different rate under the "Build Alternative" compared to the "No Build Alternative?"

	Response Percent	Response Count
Residential development will occur at a slower pace under the "Build Alternative."	0.0%	0
Residential development will occur at a faster pace under the "Build Alternative."	38.9%	7
No change	44.4%	8
No opinion	16.7%	3
Comments		
2		
answered question		
18		
skipped question		
4		

Comments:

- Residential development pace would likely vary depending on location on the corridor. The time horizon is not defined. This comment applies to many of my selections.
- We have examined housing unit and employment growth in the study area, but this growth was allocated before consideration of the capacity expansion. Three scenarios were developed and evaluated in Sheboygan County for the Sheboygan MPO transportation plan and air quality conformity analysis.




3. Will the density of future residential development differ under the "Build Alternative" compared to the "No Build Alternative?"

	Response Percent	Response Count
Residential development will occur at a lower density under the "Build Alternative."	5.6%	1
Residential development will occur at a higher density under the "Build Alternative."	33.3%	6
No change	38.9%	7
No opinion	22.2%	4
	Comments	3
	answered question	18
	skipped question	4

Comments:

- Based on the developer.
- I would think density would be higher due to concentration closer to newly defined access points to Hwy.
- Residential development may be channeled closer to STH 23 at higher concentrations if planned properly.

4. Will the character of residential development differ under the "Build Alternative" compared to the "No Build Alternative?"

		Response Percent	Response Count
Yes		22.2%	4
No		50.0%	9
No Opinion		27.8%	5

If yes, please describe.

1

answered question	18
skipped question	4

Comments:

- Easier access to country living means higher density.

5. Will the pace of future commercial development occur at a different rate under the the "Build Alternative" compared to the "No Build Alternative?"

	Response Percent	Response Count
Commercial development will occur at a slower pace under the "Build Alternative."	0.0%	0
Commercial development will occur at a faster pace under the "Build Alternative."	44.4%	8
No change	38.9%	7
No opinion	16.7%	3
Comments		3
answered question		18
skipped question		4

Comments:

- Likely focused on interchange locations.
- Provided that local zoning would allow/encourage commercial development, I would think that the pace would increase given better & more streamlined transportation on STH 23.
- See response regarding the pace of residential development question.




6. Will the intensity of future commercial development differ under the "Build Alternative" compared to the "No Build Alternative?"

	Response Percent	Response Count
Commercial development will be less intense (e.g. less impervious surface) under the "Build Alternative."	0.0%	0
Commercial development will be more intense (e.g. more impervious surface) under the "Build Alternative."	38.9%	7
No change	38.9%	7
No opinion	22.2%	4
	Comments	1
	answered question	18
	skipped question	4

Comments:

- Employment related development may be channeled closer to STH 23 at higher concentrations if planned properly.

7. Will the character of commercial development differ under the "Build Alternative" compared to the "No Build Alternative?"

		Response Percent	Response Count
Yes		29.4%	5
No		29.4%	5
No Opinion		41.2%	7
If yes, please describe.			
			2
answered question			17
skipped question			5

Comments:

- Easier access will increase commercial activity - especially at interchanges.
- Potential for higher value commercial.





8. Will the pace of future industrial development occur at a different rate under the the "Build Alternative" compared to the "No Build Alternative?"

	Response Percent	Response Count
Industrial development will occur at a slower pace under the "Build Alternative."	5.6%	1
Industrial development will occur at a faster pace under the "Build Alternative."	33.3%	6
No change	38.9%	7
No opinion	22.2%	4
Comments		2
answered question		18
skipped question		4

Comments

- Same response as w/ Commercial Development ... guarantee of better transportation throughput on STH = increase in development
- Nearly all manufacturing/industrial growth will occur in and near the City of Plymouth (minimal in the Town of Greenbush and none in the Village of Glenbeulah). Much of the growth in Plymouth is expected in or adjacent to existing industrial parks/areas.




9. Will the intensity of future industrial development differ under the "Build Alternative" compared to the "No Build Alternative?"

		Response Percent	Response Count
Industrial development will be less intense (e.g. less impervious surface) under the "Build Alternative."		5.6%	1
Industrial development will be more intense (e.g. more impervious surface) under the "Build Alternative."		22.2%	4
No change		44.4%	8
No opinion		27.8%	5
		Comments	0
		answered question	18
		skipped question	4

Comments:

No Comments

10. Will the character of industrial development differ under the "Build Alternative" compared to the "No Build Alternative?"

		Response Percent	Response Count
Yes		16.7%	3
No		44.4%	8
No Opinion		38.9%	7
If yes, please describe.			
			0
answered question			
			18
skipped question			
			4

Comments:

No Comments





11. Will the pace of future public/institutional development occur at a different rate under the the "Build Alternative" compared to the "No Build Alternative?"

	Response Percent	Response Count
Public/institutional development will occur at a slower pace under the "Build Alternative."	5.6%	1
Public/institutional development will occur at a faster pace under the "Build Alternative."	27.8%	5
No change	44.4%	8
No opinion	22.2%	4
Comments		4
answered question		18
skipped question		4

Comments:

- Limited resources would dictate little/no change.
- New hospital planned for east side of Fond du Lac - regardless of build alternative.
- We have not examined this land use issue as much as additional residential, commercial and industrial development.
- Road expansion project will open an opportunity to extend the Plank Trail to Fond du Lac.




12. Will the intensity of future public/institutional development differ under the "Build Alternative" compared to the "No Build Alternative?"

		Response Percent	Response Count
Public/institutional development will be less intense (e.g. less impervious surface) under the "Build Alternative."		5.6%	1
Public/institutional development will be more intense (e.g. more impervious surface) under the "Build Alternative."		22.2%	4
No change		50.0%	9
No opinion		22.2%	4
Comments			1
		answered question	18
		skipped question	4

Comments:

- New hospital for Fond du Lac.

13. Will the character of public/institutional development differ under the "Build Alternative" compared to the "No Build Alternative?"

		Response Percent	Response Count
Yes		17.6%	3
No		47.1%	8
No Opinion		35.3%	6
If yes, please describe.			
			1
answered question			17
skipped question			5

Comments:

- Refer to comments raised by Greenbush Town Chair at the 1/17 meeting in Fond du Lac.





14. Will the pace of redevelopment occur at a different rate under the "Build Alternative" compared to the "No Build Alternative?"

	Response Percent	Response Count
Redevelopment will occur at a slower pace under the "Build Alternative."	5.9%	1
Redevelopment will occur at a faster pace under the "Build Alternative."	29.4%	5
No change	35.3%	6
No opinion	29.4%	5
Comments		
1		
answered question		
17		
skipped question		
5		

Comments:




- Due to tremendous amounts of open space in this portion of the county, we have not examined redevelopment impacts in our growth allocations. Obviously, some redevelopment will occur, but this is most likely in built up portions of the City of Plymouth.

15. Will the density or intensity of redevelopment different under the "Build Alternative" compared to the "No Build Alternative?"

		Response Percent	Response Count
Redevelopment will occur at a lower density and/or intensity (e.g. less impervious surface) under the "Build Alternative."		5.3%	1
Redevelopment will occur at a higher density and/or intensity (e.g. more impervious surface) under the "Build Alternative."		21.1%	4
No change		42.1%	8
No opinion		31.6%	6
	Comments		0
	answered question		19
	skipped question		3

Comments:
No Comments

16. Will the character of redevelopment differ under the "Build Alternative" compared to the "No Build Alternative?" (If no opinion, write "no opinion.")

		Response Percent	Response Count
Yes		16.7%	3
No		38.9%	7
No Opinion		44.4%	8

If yes, please describe.

1

answered question	18
skipped question	4

Comments:

- Clearing the corridor of abandoned farms and business sites has started the process.

17. Indicate the level of impact the "No Build Alternative" may have on the following resources.

	Very Negative	Negative	No Impact	Positive	Very Positive	No Opinion	Rating Average	Response Count
Farmland	5.3% (1)	0.0% (0)	52.6% (10)	21.1% (4)	10.5% (2)	10.5% (2)	3.63	19
Wetlands	5.3% (1)	0.0% (0)	52.6% (10)	26.3% (5)	5.3% (1)	10.5% (2)	3.58	19
Surface Water	5.3% (1)	5.3% (1)	52.6% (10)	15.8% (3)	5.3% (1)	15.8% (3)	3.58	19
Ground Water	5.3% (1)	5.3% (1)	52.6% (10)	15.8% (3)	0.0% (0)	21.1% (4)	3.63	19
Air Quality	5.3% (1)	21.1% (4)	36.8% (7)	5.3% (1)	0.0% (0)	31.6% (6)	3.68	19
Woodlands	5.3% (1)	5.3% (1)	47.4% (9)	26.3% (5)	5.3% (1)	10.5% (2)	3.53	19
Endangered Species	5.3% (1)	5.3% (1)	52.6% (10)	10.5% (2)	5.3% (1)	21.1% (4)	3.68	19
Historic Sites	5.3% (1)	0.0% (0)	57.9% (11)	5.3% (1)	0.0% (0)	31.6% (6)	3.89	19
Archaeological Sites	0.0% (0)	0.0% (0)	63.2% (12)	10.5% (2)	0.0% (0)	26.3% (5)	3.89	19
Parkland	0.0% (0)	5.3% (1)	57.9% (11)	10.5% (2)	0.0% (0)	26.3% (5)	3.84	19
Trails	10.5% (2)	26.3% (5)	21.1% (4)	10.5% (2)	0.0% (0)	31.6% (6)	3.58	19
Community Character	5.3% (1)	5.3% (1)	47.4% (9)	10.5% (2)	0.0% (0)	31.6% (6)	3.89	19
Other (please specify)								1

answered question	19
skipped question	3

Comments:

- N/A

18. If you identified potential impacts to resources in the question above, please indicate how they might be impacted under the "No Build Alternative."

Farmland:

- The current level would not be affected or lost.
- No loss to farmland
- Less loss of land
- Less loss of farmland and damage to farm operations.
- Farmland preserved. Much easier access to farm fields.
- Less acres converted to transportation use.

Wetlands:

- The current level would not be affected, or mitigated.
- No loss of historic wetlands
- Will not increase impervious surfaces and runoff
- Less acres converted to transportation use

Surface Water:

- The current level would not be affected or lost.
- No additional displaced surface water
- Will not increase impervious surfaces and runoff
- Any road will see increased traffic... water pollutants

Ground Water:

- No additional loss of surface soils for ground water recharge
- Any road will see increased traffic... water pollutants

Air Quality:

- Air quality would be worst with congestion
- Any road will see increased traffic... water pollutants
- Increased congestion / emissions
- Slow travel on two lane road leading to increased emissions.

Woodlands:

- The current level would not be affected or lost.
- Less development pressure around Kettle Moraine Forest
- No reduction of woodland acreage
- Any road will see increased traffic... water pollutants
- Less acres converted to transportation use

Endangered Species:

- Present species would not be affected or lost.
- Less habitat pressures
- Any road will see increased traffic... water pollutants

Historic Sites:

- New entry to Wade House historic site (Greenbush), with direct access to STH 23, will be negatively affected: new facility designed to interface with 4-lane Hwy for in and out access. Could be safety factor.

Archaeological Sites:

- Less time to find and document archaeological sites that may be impacted by highway development.

Parkland:

- Less development pressure to Kettle Moraine State Forest
- No improvement

Trails:

- The Old Plank Trail would not be extended west to Fond du Lac
- The proposed trail adjacent to WIS 23 would likely be delayed.
- Plank Road multi-use trail tied to expansion; with No Build Alternative, assume trail would not extend to Fond du Lac ... a negative impact
- The Old Plank Road Trail will not be extended westward if the no build alternative moves forward.
- No improvement
- Severance of Ice Age Trail.
- Trail will be built only as part of road project

Community Character:

- Smaller communities would have fewer newcomers.
- No build will not promote new growth = stagnation

Other:

- Protection of significant resources, such as the Niagara Escarpment and current and future privately and publicly conserved properties

19. Indicate the level of impact the "Build Alternative" may have on the following resources.

	Very Negative	Negative	No Impact	Positive	Very Positive	No Opinion	Rating Average	Response Count
Farmland	11.1% (2)	72.2% (13)	5.6% (1)	0.0% (0)	0.0% (0)	11.1% (2)	2.39	18
Wetlands	0.0% (0)	61.1% (11)	22.2% (4)	0.0% (0)	0.0% (0)	16.7% (3)	2.89	18
Surface Water	0.0% (0)	33.3% (6)	44.4% (8)	0.0% (0)	0.0% (0)	22.2% (4)	3.33	18
Ground Water	0.0% (0)	29.4% (5)	35.3% (6)	0.0% (0)	0.0% (0)	35.3% (6)	3.76	17
Air Quality	0.0% (0)	16.7% (3)	33.3% (6)	11.1% (2)	0.0% (0)	38.9% (7)	4.11	18
Woodlands	5.6% (1)	50.0% (9)	27.8% (5)	0.0% (0)	0.0% (0)	16.7% (3)	2.89	18
Endangered Species	0.0% (0)	27.8% (5)	33.3% (6)	0.0% (0)	0.0% (0)	38.9% (7)	3.89	18
Historic Sites	0.0% (0)	16.7% (3)	33.3% (6)	16.7% (3)	5.6% (1)	27.8% (5)	3.94	18
Archaeological Sites	0.0% (0)	16.7% (3)	38.9% (7)	0.0% (0)	0.0% (0)	44.4% (8)	4.17	18
Parkland	0.0% (0)	11.1% (2)	33.3% (6)	22.2% (4)	5.6% (1)	27.8% (5)	4.06	18
Trails	0.0% (0)	0.0% (0)	5.6% (1)	27.8% (5)	33.3% (6)	33.3% (6)	4.94	18
Community Character	0.0% (0)	16.7% (3)	27.8% (5)	11.1% (2)	0.0% (0)	44.4% (8)	4.28	18
Other (please specify)								2

answered question	18
skipped question	4

Comments:

- Glacial Lakes Conservancy's conservation easement in the Town of Greenbush

20. If you identified potential impacts to resources in the question above, please indicate how they might be impacted under the "Build Alternative."

Farmland:

- Current level will be altered and lost.
- Loss of farmland
- Loss of farmland and severance of farm operations
- Substantial farmland will be lost to trail & corridor
- Minimal Reduction of Farmland
- New right of way needed some farm land
- Assume some minimal loss of farmland along corridor
- There will be a loss of farm acreage.
- Expansion will lead to loss of farmland
- May lose some farmland
- Farmland taken away by road and interchanges. Some fields become difficult to access.
- Some taking of farmland and/or severance of existing farms is likely to occur.
- Loss of farmland due to highway expansion
- Loss of resource to transportation use

Wetlands:

- Current level will be altered or mitigated to other areas.
- Loss of historic wetlands
- Additional impervious surface will increase runoff that may impact wetlands.
- Assumes it would be mitigated or replaced
- New right of way needed some farm land
- Wetlands always an issue; don't know specifics but assume some negative impact
- As I understand it, existing wetlands would be impacted.
- Expansion may lead to loss of wetlands
- Rely on resource agencies for objective response.
- Loss of wetland, though mitigated
- Loss of resource to transportation use

Surface Water:

- Current level will be altered or increased.
- Concentration of surface water runoff and resource degradation
- Additional impervious surface will increase runoff that may impact surface water
- Assumes actions to mitigate or improve
- More cars = more pollutants
- I do not believe the surface water in the area will be affected that much differently than with the no build. One could argue that more salt will be added due to the extra two lanes, but I would tend to believe this would be a minimal if no impact to surface water.
- Increased surface area will increase runoff
- Rely on resource agencies for objective response.

Ground Water:

- Loss of soils for ground water recharge
- More cars = more pollutants
- Same as above.
- Increased surface area will decrease recharge
- Rely on resource agencies for objective response.

Air Quality:

- Increased traffic and other activity will decrease air quality
- Assumes air quality would improve with free flow conditions
- More cars = more pollutants
- I think this is a wash.
- Little impact - more traffic will decrease air quality
- Increasing capacity should increase travel speeds, lowering VOC emissions and possibly lowering NOx emissions.

Woodlands:

- Current level will be altered and lost.
- Increase pressure to Woodland habitat
- Reduction in woodland acreage.
- Minimal reduction of woodlands
- More cars = more pollutants
- In Sheboygan County, as I understand it, there will not be a large loss of woodlands.
- Expansion may lead to loss of woodlands
- May lose some woodland
- Since the corridor passes through the Niagara Escarpment and the Kettle Moraine, some trees will likely be taken to build this project.
- Loss of resource to transportation use

Endangered Species:

- Present species may be lost or re-located.
- Increased pressure to degrade habitat
- Could be threatened during constructions, Assumes actions to minimize.
- Assume study will be performed prior to any construction
- I have no knowledge on this matter to speak confidently.
- Expansion may impact end. Species
- Rely on resource agencies for objective response.

Historic Sites:

- Potential loss of historic sites
- Easier for tourists to get there
- Would provide better access to historic sites
- Assume study will be performed prior to any construction
- In & out access to new Wade House historic site Visitor Center & Carriage Museum would be assured in SAFE fashion; access predicated on 4-lane Highway with turning lanes
- The Carriage Museum will benefit with increased access and visibility.
- Expansion may impact existing sites
- Wade House could be impacted - consult State Historical Society regarding other impacts.

Other:

- Potential loss of conservation values of Glacial Lakes Conservancy's easement property
- Would improve safety along the highway

Archaeological Sites:

- Potential loss of undiscovered archaeological sites
- Assumes actions to minimize impact
- Assume study will be performed prior to any construction
- I have no knowledge on this matter to speak confidently.
- Expansion may impact existing sites
- Rely on State Historical Society for objective response.

Parkland:

- Increased pressure to Kettle Moraine state forest
- People will have faster, easier access to parks
- Would provide better access to parks
- Provide safer more efficient access to parkland
- Our trailhead will benefit with increased access and visibility.
- No impact.




Trails:

- Easier for tourists to access
- People will have faster, easier access to trails
- May initiate trail adjacent to WIS 23
- Provide safer and more efficient access to trails
- Extension of Plank Road multi-use trail to FDL would be assured ... a very positive effect
- The Old Plank Road Trail has a much greater opportunity to be expanded under the build alternative.
- Project will expand Old Plank Trail system
- Project will extend Old Plank Road Trail and may create a safer passage under STH 23 for users of the Ice Age Trail.
- Project will enable the Plank Road Trail to be extended to FDL
- Trail construction will occur with road project, otherwise no trail.

Community Character:

- Could go either way, depending on quality of development
- Increased activity will decrease quality of life
- Would provide better access to communities
- Promote growth - Character controlled by local
- The hamlet of Greenbush will not have the same sleepy feel it currently has.
- Expansion will change character of rural areas
- No impact.

21. Are there resource(s), such as agricultural land, that are currently under pressure from activities other than the WIS 23 project?

		Response Percent	Response Count
Yes		55.6%	10
No		22.2%	4
No Opinion		22.2%	4

If yes, explain the resource(s) and the current activities that are impacting it.

12

answered question	18
skipped question	4

Comments:

- Farmland, woodland, and Endangered Species are lost, altered, or displaced by residential &/or farmland development. Surface water is altered or increased by agricultural and residential development
- Rural non-farming residential building
- Urban sprawl due to lower land prices in rural areas and inadequate land use controls.
- Farmland is being lost each year to families wishing to live in the country.
- Development
- In FDL County, how about wind farms?
- Farmlands, Woodlands, etc. associated with the Escarpment corridor and urbanization pressures from Fond du Lac metro area.
- New homes
- Building of homes and subdivisions in rural areas reduce farmed acres.
- Currently no, but when the economy rebounds, growth in and around Plymouth will impact resources.
- Ag land is under development pressure
- Development pressure on ag land over the long term in Taycheedah & Empire Towns.




22. If you answered "yes" to the above question, how might the "Build Alternative" impact the resource(s) you identified?

Response Count	
9	
answered question	9
skipped question	13

Comments:

- It may increase these same pressures; i.e., surface waters altered or increased; farmland, woodland, and ES lost, altered, or displaced.
- Loss of farmland, severance of farm operations, reduction in access, etc.
- The Build Alternative will increase the pressure by simplifying the commute.
- Same
- Probably wouldn't.
- Ease of travel may expand urbanization pressures and rural development with expanded highway.
- N/A
- It won't
- No impact. development will occur regardless of road project.

23. Are there resource(s) that may be under pressure in the future from activities other than the WIS 23 project?

		Response Percent	Response Count
Yes		55.6%	10
No		5.6%	1
No Opinion		38.9%	7

If yes, explain the resource(s) and the planned or probable activities that could impact it.

11

answered question	18
skipped question	4

Comments:

- Same as previous.
- How far into the future?
- The four-lane corridor with future interchanges will consume substantial farmland.
- Potential for ag land to be developed.
- I would say continued residential sprawl from urban areas would continue.
- Same as 'current' pressures.
- Proposed phosphorus limits will dramatically affect Village utilities (and possibly neighboring waterways).
- New homes.
- See above - growth in the Plymouth area could impact these resources.
- Ag land will continue to be under pressure from development.
- Same as above.

24. If you answered "yes" to the above question, how might the "Build Alternative" impact the resource(s) you identified?

Response Count	
9	
answered question	9
skipped question	13

Comments:

- Same as previous.
- Easy access and increased traffic will intensify business and industrial sites.
- The expanded highway may increase pressure from development.
- Because of the already short time and distance for commutes, I don't see the build alternative having a large impact on the above...at least in Sheboygan County.
- East of travel / expanded urbanization pressures.
- Within the vicinity of the Village, there would be little or no impact of the Build Alternative.
- There might be a slight acceleration of development on the north and west edges of the City of Plymouth (and adjacent portions of the Town of Plymouth) under the "build" alternative.
- It won't.
- Same as above.

25. Will economic growth and development impacts (e.g. creation of new business parks) occur under the "No Build Alternative?"

	Response Percent	Response Count
Yes	35.3%	6
No	17.6%	3
No Opinion	47.1%	8
If yes, please describe.		
		5
answered question		
		17
skipped question		
		5

Comments:

- They will occur just as they have been.
- The larger communities have plans for future development highway expansion or not.
- Consult with the City of Plymouth and the Village of Glenbeulah regarding such plans.
- Growth and development will not change due to the project.
- Business park development activity will continue in Fond du Lac. There is no activity of this type in the project area.




26. Will economic growth and development impacts (e.g. creation of new business parks) occur under the "Build Alternative?"

	Response Percent	Response Count
Yes	62.5%	10
No	0.0%	0
No Opinion	37.5%	6
If yes, please describe.		
8		
answered question		
16		
skipped question		
6		

Comments:

- Easy access and increased traffic will intensify business and industrial sites.
- I think economic growth would be stronger with the highway expansion.
- Don't know of specifics, but do believe the Build Alternative would spur economic growth in this area.
- Economy is a major factor here, more so than the highway.
- With easy access to WIS 23, there may be more potential for development in Village versus a community with no access.
- Consult with the City of Plymouth and the Village of Glenbeulah regarding such plans.
- Growth and development will not change due to the project.
- Yes, but again, not in the corridor of the road project.




27. Will new economic development initiatives (e.g., creation of a new TIF district or marketing campaign) be developed as a result of the "No Build Alternative?"

		Response Percent	Response Count
Yes		17.6%	3
No		35.3%	6
No Opinion		47.1%	8
If yes, please describe.			
			5
answered question			
17			
skipped question			
5			

Comments:

- Not "as a result of".
- Economic development planners are planning, highway expansion or not.
- Answer is for Sheboygan County only.
- If such needs arise.
- Consult with the City of Plymouth and the Village of Glenbeulah regarding such plans.




28. Will new economic development initiatives (e.g., creation of a new TIF district or marketing campaign) be developed as a result of the "Build Alternative?"

		Response Percent	Response Count
Yes		23.5%	4
No		17.6%	3
No Opinion		58.8%	10
If yes, please describe.			
6			
answered question			
17			
skipped question			
5			

Comments:

- Depends on many other factors.
- I think development initiatives would increase with improvements to the highway.
- Again, don't know of specifics, but believe there would be a positive impact.
- Answer is for Sheboygan County only.
- If such needs arise.
- Consult with the City of Plymouth and the Village of Glenbeulah regarding such plans.




29. Will social impacts occur under the "No Build Alternative?"

		Response Percent	Response Count
Yes		29.4%	5
No		29.4%	5
No Opinion		41.2%	7
If yes, please describe.			
6			
answered question			
17			
skipped question			
5			

Comments:

- Since change is inevitable, there are always social impacts.
- I am not clear what "social impacts" include.
- May have a negative impact on future economic growth.
- Answer is for Sheboygan County only.
- There is much, much higher likelihood of Village residents being involved in automotive accidents at the existing Hwy G and WIS 23 intersection.
- Severance of Ice Age Trail will impacts its users.

30. Will social impacts occur under the "Build Alternative?"

		Response Percent	Response Count
Yes		47.1%	8
No		11.8%	2
No Opinion		41.2%	7
If yes, please describe.			
			8
answered question			
			17
skipped question			
			5

Comments:

- The altering and displacement of farmlands, wetlands, woodlands, surface water and ES will all cause social changes.
- More transients will be in the neighborhood.
- Provides safer travel and opportunities for employment.
- Access within towns/townships from S to N of STH 23 will be negatively affected in places (different N-S routes). At the same time, positive impacts may occur as a consequence of new development (= new \$\$)
- Answer is for Sheboygan County only.
- Accident rates, with the proposed interchange construction, will undoubtedly decrease.
- Severance of farms will be a negative social impact, but improved trails and trail connections will be a positive impact.
- Relocations

31. As a potential addition to the Build Alternative improvements, WisDOT has identified the following long range access changes as components of a "Corridor Preservation" strategy: new interchanges at County W and County A and new grade separations at Tower Road, 7 Hill Road, Scenic View Drive, and Sugarbush Road. These are shown on Maps 1a through 1c. If these "Corridor Preservation" components are constructed, will they result in impacts which are different than those you identified for the Build Alternative? Please describe these differences and where they will occur.

	Response Count
	6
answered question	6
skipped question	16

Comments:

- Not that I know of.
- No additional impacts that I can think of, though I am not familiar with what impacts would result from potential (far-into-the-future, as I understand it) interchange at County A in Greenbush -- change in access to other roads, for example.
- It would limit development to W & A rather than having all 6 intersections be a potential for development.
- These would all offer better emergency personnel access across WIS 23.
- I concur with the impacts brought up by the Greenbush Town Chair at the 1/17 meeting in Fond du Lac.
- No

32. Are there any other projects or activities occurring now or within the next 20 years other than the WIS 23 project that might impact the study area?

	Response Percent	Response Count
Yes	52.9%	9
No	17.6%	3
No Opinion	29.4%	5

If yes, please describe.

8

answered question	17
skipped question	5

Comments:

- Potential re-building or replacement of the Sheboygan Marsh dam and/or water-control structure. Potential cessation of through-traffic of Hillview Road through Mullet Marsh.
- Wind farms
- Economic conditions, oil prices, climate change.
- Wade House historic site Visitor Center & Carriage Museum construction (now underway - completion: June 8, 2013) on S. side of STH in Greenbush has already passed review process (EIS, wetland). Moreover, traffic in and out of this new entry point to a state historic site will interface directly with STH 23. It is important that visitors have safe (i.e. four-lane with median crossover / turning lane) access to new facility.
- The upgrade and reactivation of the freight rail line between Plymouth and Sheboygan might reduce truck traffic in this corridor.
- Development of the Niagara Escarpment Greenway Plan - seeking a north/south hiking trail across corridor.
- STH 23 Corridor Preservation Study to the east (not sure what the implementation timeframe is for its recommendations, but Rob Wagner can help you out with this). There may also be projects on STH 57 in the future. Consult WisDOT on other projects in the corridor, as well as East Central Wisconsin RPC regarding projects in the Fond du Lac MPO area.
- Growth of FDL to CTH UU.

33. Are there any other projects or activities that may occur beyond 20 years that might impact the study area?

	Response Percent	Response Count
Yes	11.8%	2
No	11.8%	2
No Opinion	76.5%	13

If yes, please describe.

2

answered question	17
skipped question	5

Comments:

- See above – STH 23 Corridor Preservation study recommendations may be implemented several years in the future – Rob Wagner should be consulted on this.
- Other urban development activity.




34. Are there other impacts that are not discussed in this questionnaire that may occur under the "No Build Alternative"?

	Response Percent	Response Count
Yes	11.8%	2
No	17.6%	3
No Opinion	70.6%	12
If yes, please describe.		
		2
answered question		
		17
skipped question		
		5

Comments:

- Gradual traffic increases could render the highway unsafe during peak periods.
- The major safety concerns of the existing Hwy G and WIS 23 intersection.

35. Are there other impacts that are not discussed in this questionnaire that may occur under the "Build Alternative"?

		Response Percent	Response Count
Yes		23.5%	4
No		11.8%	2
No Opinion		64.7%	11
If yes, please describe.			
			5
	answered question		17
	skipped question		5

Comments:

- Economic conditions, oil prices, climate change.
- Yes, unforeseen impacts are sure to arise.
- Less severe accidents and thus, reduced health care costs.
- The major safety improvements with the proposed interchange construction at Hwy G and WIS 23.
- Jessica, I have a marked up map of where we think housing unit and employment growth will occur (by TAZ) in the study area between 2000 and 2035 if you think this would be helpful. E-mail me if you would like a copy of this map. I will not be providing marked up copies of your maps, as we approach future land use in the metropolitan transportation planning process differently from how it is handled in comprehensive planning - more quantification and less site mapping. Consult the local communities in regard to their adopted comprehensive plans if you need future land use plan information mapped. Jessica Potter at the Village of Elkhart Lake was with Sheboygan County Planning through 2009, and she wrote several of the comprehensive plans in the study area - you may want to interview her at some point in this process as well.